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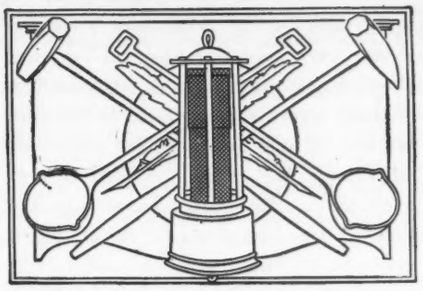

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*Illustrated.

Will Mining in Colorado be Restimulated?

There was a time when Colorado possessed the most extensive mining industry of any of the States to the west of the Rocky mountains. During the '80s no other State could boast such a galaxy of important camps as Colorado with its Aspen, Red Cliff, Rosita, Rico, Ouray, San Juan, Monarch, Telluride, Georgetown, Gilpin, and greatest of all—Leadville. The immense tonnage of ore yielded by these mines was the basis of the most important silver-lead smelting industry of the United States and a railway development superior to that of any other region in the Rocky Mountain country. During the '90s the productiveness of many of these mines dwindled or ceased, and in spite of the discovery of Creede and Cripple Creek the tendency of mining in Colorado was to ebb. Of late years it has been admittedly in a low state. Smeltery after smeltery has had to be abandoned, and Denver, once a famous mining center, has thriven upon its railway, agricultural and manufacturing interests rather than upon the industry that established it.

Recently a concerted effort to revive mining in Colorado has been inaugurated by several public organizations. The movement is, of course, supported by the railways and smelters, who are anxious to secure more tonnage of ore; by the manufacturers who are desirous of increasing the market for their machinery; by the general merchants, who are anxious to increase the sale of their goods; and in short by everyone who has an interest in the promotion of the welfare of the State.

The same condition of decadency that is most clearly manifest in Colorado is also evident in other Rocky Mountain States. The most emphatic testimony as to this is the large number of smelting furnaces out of blast. In October last we reported that the American Smelting and Refining Company in its American plants had in operation a total of only 25 out of its 56 furnaces, indicating the smelting of only about 1,250,000 tons of ore per annum in works having a capacity for 2,850,000 tons. In Colorado alone 20 furnaces out of 34 were idle, and Mr. Guiterman, the manager for that district, has recently stated that one-half the company's capacity is idle and the remainder operated on a curtailed basis. The same causes that have reduced activity in Colorado have doubtless been acting in Montana, Idaho, Utah and Nevada.

We are not saying, be it understood, that the mining industry of the West, broadly speaking, is on the wane. On the contrary the production of copper, lead and zinc ore has been steadily increasing, while the outputs of gold and silver, which to a large extent are derived from the other ores, have been well maintained. It is to be remarked, however, that the increasing production of copper is due to the comparatively few big operators, and the maintenance of the production of lead is explainable in the same way; but at the same time the business of the custom smelters, who receive ores of all kinds in large and small quantities from many producers, has materially declined, and inasmuch as this is due to the less tonnage of ore offered a recession in mining is clearly indicated.

One of the Colorado organizations seeking to revive things in that State has rationally begun its work by an investigation of the causes that have led many of the mines to fall into idleness, and in the pursuit of this inquiry has circulated a series of questions. We anticipate that the gist of the answers to these will be low prices for the metals, high freight and smelting rates, and in brief the existence of conditions that no longer permit the mines to be worked at a profit. Such an explanation will be correct in so far as it goes, but it does not go far enough.

The prices for the metals are not now materially below the averages reasonably to be expected; zinc, indeed, is decidedly above a normal average. It is idle to base hopes upon higher metal prices than now rule and in so far as this phase of the question is concerned there is nothing to be done. Any mine that cannot be worked profitably under present market conditions is not worth considering.

Nor is there much to be hoped from further reductions in smelting and railway rates. For many years the Colorado smelteries have been operated on the smallest margin of any important group and lately their managers must have had a hard time to make both ends meet. We fancy that the average smelting profit in Colorado is now decidedly less than $1 per ton of ore and if the present small profit were waived entirely, which, of course, would be economically indefensible, few idle mines, if any, would be restarted. We are less familiar with the railway situation in Colorado, but we know of some great reductions in rates and we surmise that the railway managers have done everything possible to promote traffic over their lines.

The greatest single item of expense in mining is labor, which in a broad generalization may be said to come to about 50 per cent. of the total. Labor rates in Colorado are maintained by the union, which to a large extent prevents readjustment to altered conditions, but nevertheless natural laws assert themselves and when a mine becomes unprofitable under given conditions the next step in its history is the introduction of tributers, which may amount to a reduction of wages in substance if not in name, it being in fact a sort of bonus system.

The decadence of mining in Colorado is due fundamentally to the exhaustion of ore deposits capable of profitable exploitation under existing conditions and the decline in prospecting for new ore deposits to take their place. Since the discovery of Cripple Creek in 1891 there has been no new mining district of the first class, and but comparatively few rich mines have been developed in the older districts. We hope that the organizations that are now giving attention to this matter will be able to accomplish something of value. We think they will if they stick to it. The campaign of publicity that has been inaugurated in certain quarters, even if frothy, will do good in dispelling the erroneous idea that mining in Colorado is nearly dead, which is not so. More serious publications will do good by informing mining men as to facts and preventing quixotic ideas. The field for most serious work, however, will be advising of the mine operators of the State to make more use of engineering services for the improvement of methods of mining and milling, and of geological services for the study of ore deposits, for it is in those directions that lies the real hope for the rejuvenation of the industry.

Such an old mine as the Madonna was lately found to have a new orebody that had long escaped discovery and perhaps it has others. Similar good fortune may come to other famous old properties, but if such be in store for them the development will be chiefly due to geological and engineering study, even if there be some scoffing of both for their failure to detect the calamine of Leadville. Although a little laugh over that may be enjoyed, the value of geological services is now too well established to be decried. Apropos of this, a prominent mine operator, speaking of his own business, remarked recently that whereas in drilling prospecting holes he formerly might find ore in one out of ten he now, with the benefit of excellent geological advice, had a discovery percentage of ninety.

The Colorado committees can usefully conduct a propaganda of education upon the above lines. They can, perhaps, in some cases urge specific investigations and discountenance visionary and wasteful schemes. They can advise moderation on the part of property holders in the cases where capital is required. They can frown upon the operations of wildcatters and perhaps act militantly against them. It will all depend upon how earnestly the organizations and their committees go into the matter, how much they will be prepared to spend, and how much work they will do. It is always work, not talk, that accomplishes results, although talk may be required to get the work started.

The Campaign Against Fraud

On Nov. 21 the Postoffice Department signalized itself by raiding Burr Brothers, Incorporated, on charges of using the mails to defraud. This notorious concern had been engaged since 1907 in selling stock of wildcat petroleum and mining companies, the list of which is too long to be repeated here. It is sufficient to say that the names of most of them are unknown in the legitimate mining industry. Using the crude, old-fashioned methods, without the benefit of stock-market manipulations, laundry machinery, etc., they are reported by the postal authorities to have drawn large sums of money from unwary persons, chiefly of the more humble sort.

The raid eliminating this concern was conducted under the orders of Postmaster-general Hitchcock, who came personally to New York to direct it, and afterward gave out an official memorandum respecting it. From this and other remarks by the Postmaster-general it is evident that there are more raids of the same kind to come and that the Administration is vigorously pursuing its policy of arresting the evil of fraudulent promotion that has been sucking away so much of the savings of the poor people. This is an eminently practical and praiseworthy reform, for which the Administration is to be commended, especially by all interested in the welfare of the mining industry.

The recent actions of the authorities have already caused many of the fraudulent promoters to tremble and become circumspect. It ought also to cause those newspapers accepting their advertisements and thus becoming *particeps criminis* to reflect upon the error of their ways and consider seriously the recommendations of the Hughes Committee touching upon this point.

The latest news from Mexico is grave. The interest of the mining industry is immense. This is a time for Americans to keep their heads.

CORRESPONDENCE and DISCUSSION

Views, Suggestions and Experiences of Readers

Coal Mining Methods in Gold Mines

The article on Transvaal mining practice by the Johannesburg correspondent of the JOURNAL, published in the Nov. 12 issue is interesting, as showing the trend of progress in mining practice on the Rand. However the ideas advanced are not new to gold mining, being, in fact, in large part only adaptations of practice that prevails in other camps where the conditions are similar. The correspondent makes the statement that the policy of a large Rand house is to secure an engineer familiar with coal mining to plan a system for mining beds of banket that dip only from five to 25 deg. from the horizontal; also that a circular shaft will be sunk to develop the orebodies.

The circular shaft has been used for metal mines but has never found general favor in the United States, so additional information on this subject will be interesting. The plan of development favored is, according to the article above mentioned, to lay out levels 500 to 600 ft. apart on the dip and to run main-haulage levels in the footwall at 1800- to 2000-ft. intervals. In these levels endless-rope haulage will be used and all ore will be run down self-acting haulages to them for conveyance to shafts.

There is no doubt but that the tail-rope haulage will materially reduce costs where the main-haulage levels are extensive and a large tonnage is to be handled. It must, however, be remembered that such installations are only warranted under these conditions. As to the use of self-acting inclines between main-haulage levels, it should be remarked that this is not novel in gold mining, this system having been used for years at Grass Valley, Cal.

GRAVITY PLANES USED IN GRASS VALLEY MINES

The North Star Mine at Grass Valley is developed to a depth of 5400 ft. on the incline and gravity planes, locally termed "go-devils," are used to deliver ore to the main-haulage levels that connect with the shaft. Small cars are used on these inclines, the loaded car pulling the empty up the track in each case. The go-devil cars dump automatically on tipples discharging into pockets from which the cars on the haulage levels are loaded —or directly into these latter. Between main-haulage levels intermediate levels that have no direct connection to the shaft are run as required in the mining of the veins. This system has proved economical and is a most satisfactory solution for the problem of working flat stopes in which the broken ore will not run of itself. The go-devil cars and track are light and inexpensive and the only other equipment required is a triple-block or a wooden reel with suitable braking device to insure control of the cars. At Grass Valley the go-devil cars usually have a capacity of less than one ton, as in the narrow veins it is necessary to use small cars if little extra excavation is to be done in the raises in which the gravity planes are installed. With small cars light ropes and a less complicated braking arrangement can be used. The cost of such an equipment is low.

At Grass Valley the interval between haulage levels is seldom over 300 ft., but this distance could be easily extended and larger cars and heavier tracks used wherever conditions warranted. The scheme of mining is precisely the same, only on a smaller scale, as that reported to be outlined for the Transvaal mines. J. T.

New York, Nov. 17, 1910.

Proposed Amendment for Location of Lode Claims

I should like to propose an amendment to Sec. 2320 of the U. S. statutes so as to allow miners to locate claims 600 ft. in width without the restriction to take 300 ft. at most on either side of the vein.

I never could see any reason why prospectors and miners should be prohibited from locating their claims to the best advantage, as long as they did not exceed the maximum width permitted by the law. Frequently it would be desirable to take 100 ft. beyond the outcrop and 500 ft. on the other side to cover more of the dip of the vein, because later development may prove that the location has no extralateral rights. In such a case the locator would have much more ground in the direction of the dip of the vein than he would have under the present law, which confines him to a width of not more than 300 ft. on either side of the vein.

All those familiar with mining and the location of lode claims will see at once how such a change in the law would enable the discoverer to lay out his claim to the best advantage, as far as the facts on the ground dictate. It is not necessary to point out the many ways in which such a change in the law would be helpful to the prospector, especially now, since the forest reserves threaten to interfere considerably with an easy and free entry into the national domain. I can see no objection to this amendment and all will admit that it is helpful to the miner. I submit this proposition for discussion among the readers of the JOURNAL. The change of a few words in Sec. 2320 will accomplish the object. I have suggested this change to the Colorado members of Congress and I hope to find assistance in this matter by asking the JOURNAL to publish this communication. MAX BOEHMER.

Denver, Colo., Nov. 17, 1910.

The Prevention of Mine Accidents

In the JOURNAL of Sept. 24, 1910, special attention was directed to the number of persons killed annually by accident in the metalliferous mines of the United States, and to the necessity arising therefrom for uniform legislation and an adequate system of mine inspection. As Great Britain is generally credited with advanced legislation and a model system of mine inspection it may be interesting to compare the record in that country over a period of years.

MORTALITY AND PRODUCTION DATA FOR GREAT BRITIAN.

Year.	Persons Employed	Minerals Output Tons.	Deaths.	Death Rate Per 1000.
1873	62,683	3,797,589	104	1.66
1900	34,465	3,590,650	38	1.10
1901	32,443	3,230,565	30	0.92
1902	30,812	3,322,820	29	0.94
1903	29,823	3,243,633	25	0.84
1904	29,504	3,246,336	35	1.19
1905	29,151	3,444,478	46	1.58
1906	30,231	3,712,436	36	1.19
1907	31,602	3,388,024	34	1.08
1908	29,927	3,138,728	37	1.24
1909	28,437	3,095,780	40	1.41

Published statistics show that in Great Britain there has been a most remarkable decline in the number of persons employed about mines, ranging from 62,683 in 1873 to 28,437 in 1909. The slight reduction of aggregate mineral output from 3,795,589 tons in 1873 to 3,095,780 tons in 1909 is out of all proportion when the disparity between the labor engaged in the respective years is taken into consideration. As to the annual death rate there is not a pronounced improvement. The most favorable figure is exhibited in 1903 when the record was 0.84 per 1000 persons employed, but in the interim the tendency has again been upward. The

figures for the whole of Great Britain, exhibited in an accompanying table enable a general comparison to be made.

Those tabulated are the combined statistics culled from the reports covering the various inspection districts, but it may be contended that what has been known as the Southern district, embracing the county of Cornwall is more similar to the metalliferous mining areas of the United States. Accordingly the Southern district reports of recent years will be examined in greater detail with a view to placing before readers the accumulated wisdom of Joseph S. Martin, mines inspector, who has lately retired under the civil-service age limit. The conclusions arrived at are those set forth in the official documents issued from time to time by the Home Office.

Ignorance as to Danger of Frozen Nitroglycerin Compounds Prevalent

In 1904 a young miner was killed by an explosion of gelignite which he had brought from the surface in two tins. The gelignite in some unexplained way received a shock and exploded. No definite information as to the cause of the explosion could be obtained, but the inspector favored the view that the gelignite had not been long enough underground to thaw by the natural warmth of the mine. At the inquest he was astounded by the prevailing ignorance as to the danger of using frozen gelignite and other nitroglycerin compounds. Men who had been using these explosives for many years knew nothing of the danger, although they were in the habit of frequently carrying the cartridges about them for the purpose of thawing, they only did so that the explosion might do better work. The inspector was so completely surprised that he made representations to the Home Office, culminating in the issue of a circular calling the attention of owners of metalliferous mines to accidents from the use of explosives containing nitroglycerin.

Proper Thawing of Explosives

It was directed that such explosives should always be thawed by means of hot water only, before use. Miners and others engaged in the handling of explosives do not realize the need of adopting proper means for thawing explosives, and are apt to imagine that explosives do not require to be thawed except in times of frost. Explosives which contain nitroglycerin become solid or frozen at a temperature much above the freezing point of water and when once solidified require a considerable amount of heat to soften them again. Hence it frequently happens that the centers of the cartridges are found to be hard during the late spring and even in the summer months. The secretary of state approached the manufacturers of the explosives in order to assure that the warning notices issued by them with explosives of this class should be as prominent and explicit as possible, and further directed that the following special notice should be exhibited by the owners at the mine.

"All cartridges made of dynamite, gelignite, blasting gelatin and other explosives containing nitroglycerin, must always be thawed (in a properly designed warming pan) before use during the months of December, January, February and March, and also at any other time if the cartridges are not in a soft or pasty condition."

Accidents Also Attributed to Lax Discipline

Mr. Martin frequently appealed for improvement in organization and discipline, regretting that accidents occurred as a result of discipline not being sufficiently appreciated in metalliferous mines by the agents or the men. Special reference is made to a regrettable incident in 1906, "due to laxity of discipline," which killed a man at Dolcoath. Notwithstanding that it is understood to be prohibited to take tools in the "gig" when men are riding, one of the miners when descending took a drill in his hand and when part way down let it fall out of the gig, whereupon it struck the side of the shaft, and, rebounding into the lower deck in which the deceased was riding penetrated his side, causing death the following day.

In 1908 the death rate from accidents below ground reached 2.46 per 1000 persons employed, and in a general comment is stated that a number of cases were beyond the control of either the employers or the men; others were due to errors of judgment in regard to the effect of the immediate action or work of the men themselves; a few were attributable to acts of omission or commission on the part of the men or their comrades; some others were perhaps more or less indirectly due to lack of close supervision and enforcement of discipline.

In 1909 the number of accidents and deaths was heavy and the figure for Cornish mines compared badly. For a number of years the ratios of deaths in the district improved steadily, but they rose again and still continue high under the same inspection and management. Mr. Martin fails to understand this, but it is nevertheless a fact that runs of good and bad luck do occur in this way. The inspector's experience with the managers has shown that they are not callous as regards the safety of the men working under them, but on the contrary they are desirous of safeguarding both life and limb so far as is really within their power.

Coal Mines Little More Dangerous Than Metal Mines

Mr. Martin does not altogether agree with the view that metalliferous mines are so much safer for workmen than coal mines. He suggests that "if critics had experience in both classes of mining, and would bear in mind the size of the huge cavities in some of the metalliferous mines, and the utter impracticability of complete and careful examination being made frequently, as well as the numerous dangers met with in this class of mining, they would perhaps realize that there are sets-off as regards dangers in the one against the other. . . . Various improvements have been introduced in Cornwall and further improvements are desirable and will no doubt follow, even if slowly; but difficulties exist, prejudice has its position in such matters, money is difficult to earn by working the mines, and when earned it is perhaps more difficult to keep from the shareholders' pockets, a custom which, like many others, dies hard, although those who are steady investors know in most cases that well directed expenditure may be desirable, if not absolutely necessary from all points of view." R. H. Coulson.

Wigan, Eng., Nov. 4, 1910.

Shaft Plumbing

In the Journal of July 23, Mr. MacCoy contends with humorous simile, that a 50- to 60-lb. plummet is unnecessarily heavy for use in the shaft plumbing, even under adverse conditions, and that to support, for 1000 ft., such a bob would require a No. 8 wire (0.13-in. diameter). The wire actually used in plumbing a shaft 500 ft. deep was approximately 0.016 in. in diameter, i.e., a No. 25 B. & S. gage, and it carried a weight of 59 pounds.

In Trumbull's "Underground Surveying" are given methods employed in various mines, from which the following examples are taken. At the Old Dominion Copper Mining and Smelting Company, 50-lb. lead bobs are used; in the Tamarack No. 5 shaft, even with 50-lb. bobs hung on No. 24 steel piano wire, the wires were 0.1 ft. further apart at the 4000-ft. level than at the surface. As an extreme case may be mentioned that described by W. E. Downs, where in plumbing the unusually wet and difficult Oneida shaft, 2000-ft. deep, he used 125-lb. plumb-bobs hung on No. 12 gage soft-drawn iron wire.

The advantage of using heavy bobs when working under adverse conditions, is, of course, that whereas the exposed surface of the wire on which the air currents and falling water act increases as the first power of the diameter, the strength of the wire, depending on its cross-sectional area, increases as the square of the diameter; hence by the use of slightly thicker wires and heavier plumb-bobs, the risk of serious deflection of the lines may be reduced to a minimum.

S. B. Greenfield.

El Oro, Mexico, Nov. 24, 1910.

The Campaign Against Fraud

Burr Brothers, Incorporated, having offices in the Flatiron building, New York, was raided by the postal authorities on Nov. 21, and Sheldon C. Burr, president, Eugene H. Burr, secretary-treasurer, and Frank H. Tobey, vice-president, were arrested and upon arraignment before Commissioner Shields were each held in $10,000 bail. Later in the same day the Continental Wireless Telephone and Telegraph Company was raided. With respect to these raids, Postmaster-general Hitchcock made the following statement:

"Burr Brothers have organized the following oil companies: Coalinga Consolidated, capitalized at $1,000,000; Coalinga Aladdin, $1,000,000; Kern-Western, $750,000; Coalinga Crude Oil, $500,000; Peoples Associated Oil Company, $1,000,000; New York-Coalinga, $500,000. All the stock in these companies has been sold except a portion of the first two named and the greater portion of the money has evidently gone into the hands of Burr Brothers, Inc.

"The Burr Brothers have also organized, promoted and sold stock in the following mining companies: Rawhide Tarantula, with a capital of $1,000,000; Montezuma Mining and Smelting, with a capital of $1,000,000; Montezuma Extension Gold Mining, with a capital of $1,000,000; Golden Fleece Mining, Milling and Refining Company, with a capital of $500,000. Practically the entire stock in these companies has been sold to the public, and all these companies have gone out of existence.

"The Burr Brothers have also organized, promoted and sold the stock of the following companies: Ellsmere Farm of Michigan; California Eucalyptus Timber Company, capitalized at $1,000,000, and the New Amsterdam Securities Company, with a capital of $100,000, which was later merged with Burr Brothers, Inc.

Some of Burr Brothers' Alleged Mining Companies

"They have also sold large amounts of stock in the Red Top Mining and Leasing Company, capitalized at $1,000,000; Long Beach, Mexico and Arizona Mining Company, capitalized at $1,500,000; Nevada Goldfield Mining, Milling and Smelting Company, capitalized at $5,000,000; United Standard Lead and Zinc, capitalized at $1,000,000; Florence Consolidated Mining and Leasing Company, capitalized at $1,000,000; Round Mountain Central Mining, capitalized at $1,000,000; Cobalt-Portage Mine Company, capitalized at $1,000,000; British-American Copper Mines and Smelter Company, capitalized at $5,000,000; Arizona Copper-Gold Mines Company, capitalized at $1,500,000; Searchlight Canina Gold Mining Company, capitalized at $1,000,000; Holcomb Automatic Engine Company, capitalized at $5,000,000, and the Cotton Wood Copper Company, capitalized at $1,000,000. All of these companies are at present out of existence.

"They have sold stock in the Happy Jack Copper Mining and Development Company, capitalized at $500,000; Yukon Basin Gold Dredging Company, capitalized at $1,000,000; Toledo, Wabash and St. Louis Railroad, capitalized at $6,000,000; Chicago-New York Electric Air Line Railroad, capitalized at $2,000,000, in connection with the Coöperative Construction Company, capitalized at $1,000,000. All of this last group of companies are in existence at the present time.

"They also sold the stock of the Vitak Company, a $1,000,000 corporation, which is now in the hands of a receiver, and they are at the present time also engaged in the sale of lots in Lincoln, N. J. It can safely be said that they have sold stock at par value of from $49,000,000 to $50,000,000 in the various companies; have an extensive suite of offices in the Flatiron building, this city, and at times have had offices in Cleveland, Chicago, Los Angeles and San Francisco. During the past summer they were driven out of California by the State authorities.

"In every instance they have promised large dividends on the stock sold in addition to an increase in the value of the stock, but not in a single case have any of the companies paid any dividends, and as stated above, practically all of them have been complete failures. The Department has received several hundred complaints from people who have bought this stock and lost their money.

* * * *

"The arrest today by postoffice inspectors of the principals in two important companies, Burr Brothers, with offices in the Flatiron building, and the Continental Wireless Company, with headquarters at 56 Pine street, constitute two more cases in the series of investigations that the postal authorities have been making in their crusade against the fraudulent use of the United States mails. With the work accomplished today 78 such cases have been brought to a head during the year. It is estimated that the swindling operations of these 78 cases have filched from the American people in a period of five years over $100,000,000.

A Crusade in Progress

"The crusade now in progress is the result of a carefully laid plan of some months ago, the first step in which was a thorough reorganization of the inspection service, with the selection of a new chief postoffice inspector and certain changes and reassignments in the force of inspectors in charge of the 15 inspection divisions. As soon as the reorganization was effected instructions were issued to the newly assigned inspector in charge to take up and prosecute vigorously all pending cases of frauds against the mails. Owing to the extent of these cases and the large amount of work involved it was necessary to detail for the purpose of investigation a considerable portion of the force of postoffice inspectors. The best men in the service were selected for this work and were sent to their tasks with the assurance that the Department at Washington would back them up to the fullest extent in the work of prosecution. In order to strike at the root of this evil the Department directed its agents to go after the men higher up in these gigantic schemes to defraud and to allow no influence, however powerful, to prevent the proper punishment of the offenders. Through the assistance of the Attorney-General the full coöperation of his department was secured in the successful carrying out of this crusade.

The Policy of the Administration

"As the work of investigation proceeded it became apparent that the fraudulent use of the mails was far more extensive than had been realized by the Department. A vast system of fraud, as far reaching in its ramifications as the postal service itself, had been developed by unscrupulous men who through the grossest forms of misrepresentation were stealing from the people millions of dollars annually. These fraudulent operations have not only swindled thousands of innocent investors, but have created a lack of confidence in legitimate business enterprises. It is, therefore, as important to the business community to have these frauds stopped as it is to the people whose losses are directly traceable to them. Formerly the procedure in such fraud cases was entirely different. It was the practice to issue a fraud order against the guilty concern. This method proved to be ineffective. While it deprived the offending concern of the use of the mails it was a simple matter for its promoters to reorganize under a new name and thus evade the law. In the Department's present crusade the practice has been to proceed immediately to the arrest of the principals in the fraudulent enterprises, the object being to secure the prompt conviction and imprisonment of the men who organize and promote these schemes to defraud. The results already accomplished by the Department represent only the beginning. The work of investigation and prosecution will proceed with all possible vigor until the swindling of the people through the use of the mails is brought to an end."

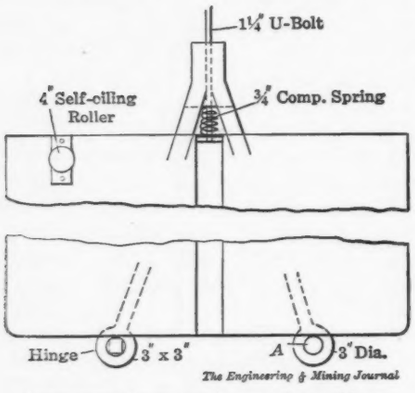
DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Skip Improvements

The new skips that are being made for the Adams mine, near Virginia, Minn., are equipped with ¾-in. compression springs underneath the crosshead to lessen the shock on the cable when starting to lift the skip full of ore. The use of springs on skips is not common, although they have been used on cages.

In the old skips two 3x3-in. iron bars were used under the skip to support the load. The skip is hinged to one of these bars for dumping purposes, and when vertical simply rests on the second one, marked *A*. These two bars are about 18 in. apart. Dirt will accumulate on the top of *A*, if square, and prevent the skip from occupying its true position; hence the use of round bars. The skip being



IMPROVED SKIP AT ADAMS IRON MINE

5 ft. high, ½ in. of dirt or ice will throw the top of the skip 12/3 in. out of plumb.

Pipes as Part of Electric Circuits

At the Baltic mine, Palatka, Mich., the air, water and steam pipes in the shaft are bonded together at the upper and lower ends and are used as a ground line for the electric circuit. Only one copper cable is run down the shaft. This cable is insulated and is supported by glass insulators on every alternate set of timbers.

While this does save in the cost of copper cables and makes one less wire to maintain in the shaft it seems that electrolysis would deteriorate the pipes to such an extent as to more than offset the advantages gained. Wherever it is possible in the mine, the pipes and the car tracks are used as the return part of the circuit, the same as in an electric tramway in which the rails form part of the circuit. In this way only one wire is run into most of the mine workings, even where electric lights are in use.

The Kidney Pulp Distributer

BY CLAUDE T. RICE

The one completed section of the Ohio Copper Company's mill at Lark, Utah, is treating without any crowding about 50 per cent. more ore than it was designed to handle. One of the explanations for this no doubt is the system of making tailings on most of the tables and then cleaning the dirty concentrates from these tables on other tables where closer watch can be kept. There is thus a heavy feed of sulphide to the secondary tables so that in the riffles the smaller grains are covered by the larger ones, and so are somewhat protected from the force of the current required to wash off the larger particles of the gangue minerals. But another explanation unquestionably is found in the exceptionally even distribution of the pulp to the different tables that is obtained in this mill. In the treatment of large tonnages, especially where there is a wild attempt to load every device to the limit, as is the present tendency at many mills, it is important to have the pulp distributed equally to the different.

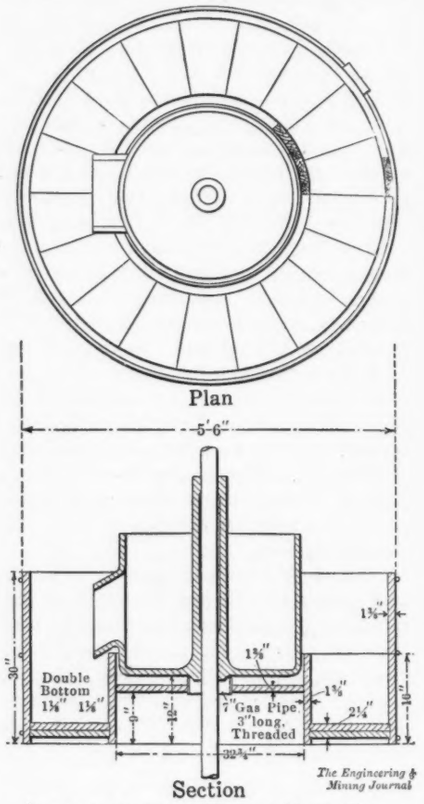
The Kidney distributer, which is used at the Ohio mill, was devised by William Kidney, superintendent and also the designer of the mill and the system of concentration used. This distributer has one drawback, i.e., whenever the feed has to be shut off from one table or unit that is being fed by the distributer, the equilibrium of the feed to the other tables is disturbed, as will become evident when the construction of the distributer is understood.

A COMPARTMENT FOR EACH DEVICE FED

An accompanying halftone illustration shows the general appearance of the distributer, while the line drawing shows the details of the design. The distributer consists of a rotating cylinder with feeding lip, into which is led all the pulp going to the tables or other devices that the distributer is serving. This feed cylinder stands in the center of an annular wooden tank which is divided by partitions into as many compartments as there are devices to be fed. The size of this annular tank is such that the different compartments just empty themselves during one revolution of the feed spout. This assures an even feed to the different compartments, but in all cases at the Ohio mill a thickener or else a feed box is used before each of the tables or the chilean mills.

FEED IS EQUALLY DISTRIBUTED

The feed cylinder rotates at 15 r.p.m., and necessarily, as the speed spout passes



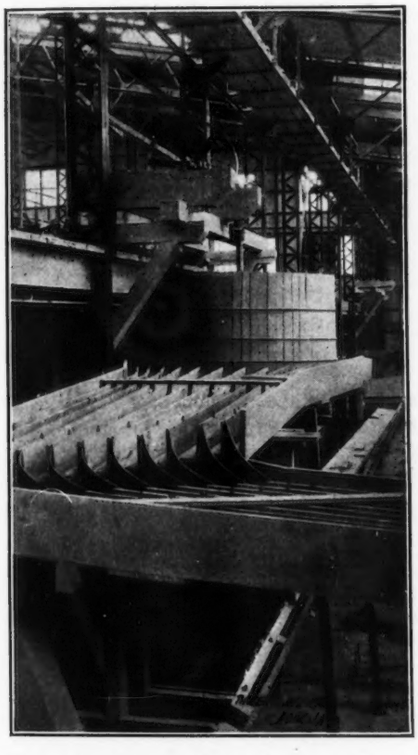
ARRANGEMENT OF KIDNEY PULP DISTRIBUTER

at uniform speed over the annular tank and as the compartments are all of equal size and are similar in shape, each device gets an equal and similar feed. The feed from each compartment is taken by a short 3-in. gas pipe to one of the component launders of the trunk launder serving one group of devices. By the use of these trunk launders the confusion overhead, caused mainly by the individual-launder system, is avoided. The accompanying halftone cut shows the trunk launder leading away from one of these distributers.

DETAILS OF CONSTRUCTION

The distributer is driven by a system of bevel gears so as to cut down the

speed, as the driving belt comes from the main shafting. In order to take the wear, the revolving feed cylinder is provided with a sheet-steel lining. The cylinder itself is made of cast iron, while the annular tank is made of wood. The end of the shaft that carries the feed cylinder extends below the bottom of the tank and rests in a step bearing. The outer staves of the annular tank are 30 in. long so as to take the slop of the heavy feed which in several instances goes to the distributer. The inside staves are 16 in. high. The dividing partitions are only fastened by means of nails so that they can be changed in case it becomes necessary. All bearings are equipped with grease-cup oilers.



VIEW OF KIDNEY PULP DISTRIBUTER IN OHIO COPPER MILL

DISTRIBUTERS HAVE GIVEN SATISFACTION IN OHIO MILL

If for any reason it is necessary to cut off the feed to any one of the devices served, a plug is put in the discharge pipe from that compartment of the distributer. But obviously this causes that compartment to fill with pulp, and then the portion of the pulp that should go to the device which is shut down, is thrown into the two neighboring compartments, producing an overload in these. But this is a small drawback to the distributer, for such a condition is only a temporary disturbance. Otherwise an absolutely even feed is obtained by means of this distributer and during the nine months that the Ohio copper mill has been in operation these distributers have all worked satisfactorily. They are used throughout the mill wherever it is necessary to divide the feed going to different devices. The distributers can, if necessary, be mounted one above another on the same shaft, but the necessity for doing that would seldom arise.

Since the obtaining of a maximum tonnage and efficiency of concentration from a given equipment depends mainly upon giving an equal load to each of the individuals in the unit, the use of this or some similar distributer is of great advantage in concentrating mills. Good work is impossible when one table is underloaded at the expense of an overload on another table. Cyanide men have realized this for some time and mill men are gradually appreciating this fact. The Kidney distributer is not patented and can be used by anyone without the payment of royalty. The distributers are rather expensive to make, but they soon pay for themselves where large tonnages are being treated.

Poisoning by Cyanide

The committee of the Mining Regulations Commission of Transvaal, appointed to look into the matter of poisoning by cyanide, circularized mine managers, cyanide managers and the leading metallurgists in the Transvaal.

From 55 replies received, the following conclusions were reached: (1) That cyaniding is *per se* a healthful occupation; (2) that the number of fatal cases of cyanide poisoning by drinking is compartively small and attributable almost without exception to carelessness or pure accidents; (3) that cyanide eczema, occasionally noticed among those who have to handle zinc shavings in the precipitation boxes, is unknown where the cyanide solution is replaced by water previous to the zinc shavings being handled; (4) that many cases of "gassing" occur among those who are engaged in treating the gold slimes from zinc-extractor boxes by the acid process, on account of the hydrocyanic acid gas and the arseniuretted hydrogen given off.

PREVENTIVE MEASURES

The necessary preventive measures suggested by the foregoing considerations include the following: (1) The provision of an adequate supply of wholesome drinking water about plants and assay offices, the same to be distinctly labeled "Drinking Water;" (2) the replacement of strong cyanide solution used in the precipitation boxes by water previous to the zinc being handled; (3) the effective hooding of the dissolving bath in which the gold precipitates are treated, and the use of some form of mechanical agitation in order to eliminate the necessity of raising the hood.

TREATMENT OF CASES OF ACCIDENTAL POISONING

It is recommended, that boxes labeled "Antidotes for Cyanide," with directions for use affixed to the lids of the boxes, should be kept in prominent and easily accessible parts of the cyanide plants. Each box should contain: A spoon and a metal receptacle to hold about one pint; one blue hermetically sealed vial containing 30 c.c. of 33 per cent. solution of ferrous sulphate; a white vial containing 30 c.c. of caustic potash, and one package of oxide of magnesium (light). The directions for the use of the antidote should be as follows:

Preparation of Antidote—Quickly empty the contents of the blue vial, of the white vial, and of the magnesia package into the metal receptacle, and stir well with the spoon. This should be done as rapidly as possible, as the patient's chance of life depends on promptness.

Administration of the Antidote—If the patient is conscious make him swallow the mixture at once, and lie down for a few minutes. If the patient is not conscious, place him on his back and pour the mixture down his throat in small quantities, if necessary pinching his nose in order to make him swallow.

Incite Vomiting—After the antidote has been given, try to make the patient vomit by tickling the back of the threat with a feather or with the fingers, or giving a tumblerful of warm water and mustard.

Moisture as a Source of Error in Assay Reports

BY GEORGE A. JAMES*

The item of moisture, although of vital importance in the accurate calculation of mill savings and cyanide results, seems to be more honored in the breach than the observance. I recall few references to it in text books, and seldom see an evidence of its observance in reports.

If a sample reaches the assay office dry enough to pass readily the sieves used, it is taken for granted that the sample is dry; but if one has had experience in any ore-purchasing company, this detail is found the Nemesis of ore buyers, and the chief cause of the popular belief that they are, in general, thieves. It is the exception when ore is found running less than 2 per cent. moisture, and in cases, I have seen seemingly dry samples, with moisture exceeding 10 per cent. It is obvious that where this error is not considered, returns will have a ridiculous relation to facts. Moisture is invariably found. Where samples are properly dried

*Assayer, San Francisco, Cal.

in the water bath the error is bad enough, but in cases where combined water is expelled by heat above 100 deg. C., the error is increased proportionally.

The final result in most metallurgical processes is determined by the loss in tailings, and as these are usually recovered from solutions and are well dried (or even roasted), before assays are made, the losses are estimated from concentrated samples as against an original value in diluted samples. The same error is involved in most work of the assay office. Mine samples are generally assayed without allowance for moisture, and ore reserves estimated on dry weights.

Reabsorption of Moisture Causes Trouble

Assayers who have chemical experience, well know the difficulties of keeping samples dry long enough for accurate weighing, and as the fineness or flocculency increases, this trouble is augmented greatly. By actual test, in the climate of San Francisco, a fused silicate was found to have absorbed nearly 20 per cent. of moisture and gases in four hours' exposure in the open air. It has a large influence on control and umpire work. The check samples are generally submitted for assay in paper bags, and when finally they reach the assayer, they have had time to reabsorb moisture rarely less than 2 per cent.

The final error is vastly greater in the case of cyanide precipitates, sulphides and jewellers' sweeps and rich samples in general, for in such cases modern custom demands extreme fineness of sample; thus it happens the longer the shipper keeps his sample, or the further it is sent to umpire, the greater chance he has of standing the cost of said assay, and losing the contest. The proof of this may be had by heating any sample of pulp in a test tube and observing the moisture that will condense in the cold portion of the glass from the steam expelled.

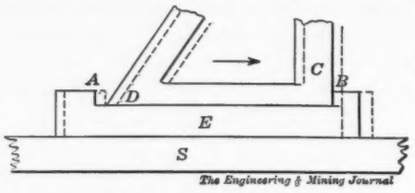
Although these things may be considered by assayers, as yet they have not come to my notice in assay reports I have seen. I shall not call attention to cases not mentioned in the above where such errors may have a bearing; but many suggest themselves. Perhaps the seeming increase in value of some mines with depth may be because of the comparison of undried samples of the upper, with dried samples of the lower levels.

According to a report made to the Geological Society of Mexico by Prof. Juan S. Agraz, a meteorite found on the Arenalas ranch, 88 km. northwest of Durango, contained: Iron, 96.60 per cent.; nickel, 0.99; cobalt, 2.39; carbon, 0.13. This is the first time carbon has been reported in any of the many meteorites found in Mexico.

A Simple Device for Cross Hatching

By W. H. Faulkner*

A simple but effective device was suggested to me while laboriously attempting in the smallest possible time to make some cross-hatching appear presentable. A modification by which it could be applied to any size of block lettering, and to any interval of spacing in the cross-hatching suggested itself to me; the following description is given in the hope that others may find it useful. The apparatus in its simplest form consists of a templet, made of a piece of wood, about ¼ inch thick, shaped as shown by *E* in the diagram with the distance between the butts *A* and



Cross-hatching Device

B long enough to allow one side of a triangle to be placed between them, and leave a space equal to the width required for the component parts of the letters, or the spacing of the line in cross-hatching. A templet made in this way can, of course, only be used (except by the use of different-sized triangles) for a particular interval. This inconvenience is overcome by a slight modification, by which one of the butts is made adjustable.

The method of use is as follows: The triangle is placed with its edge *C* against the butt *B*. The triangle is then held down firmly with the fingers and the templet slid along with the thumb, so that the butt *A* is brought against the corner *D;* then holding the templet firmly with the thumb, the triangle is moved along with the figure over the space left by the previous movement of the templet, until the edge *C* again comes in contact with the butt *B*. In this way, by the alternate movements of triangle and templet the triangle is brought into successive positions at equal distances apart. One hand only is needed in the manipulation, the other being left free for the pencil. In the diagram, *S* is a straight-edge, firmly held in position, parallel to the direction of the lettering, and along which the templet is moved. Care must be taken that each piece is alternately held firmly, while the other is being moved, and the tendency of the templet to move away from the straight-edge must be avoided, but with a little practice no trouble is experienced from this.

*Mexico Mines of El Oro, El Oro, Mexico.

Block Lettering

For block lettering the templet is adjusted to leave a space between the triangle and butt equal to the thickness of the component parts of the letters. The usual six parallel lines are then drawn, at the set width apart, and the spacing for the letters then marked off. Further time can be saved by omitting the unnecessary lines, counting up the space as one proceeds, and only making outlines of the letters.

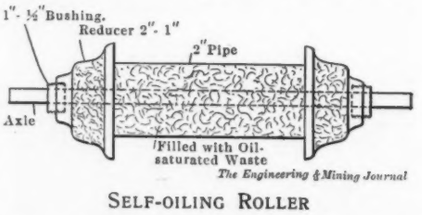
This method will be found to produce better results in a shorter time than the usual tedious method of spacing, by moving a triangle along a scale, where much time is lost in seeing that the scale division and triangle correspond. For cross-hatching in which the spaces do not have to be counted up, the results are still more satisfactory.

The principle is, of course, that of the section liner; but the apparatus described can be easily and quickly made on the premises; whereas a section liner might be considered an unnecessary luxury, where its use is only required occasionally.

Self Oiling Roller

By L. W. Armstrong*

The accompanying sketch shows a serviceable and convenient roller devised by Robert L. Armstrong, foreman of the Copper King mine. It is made up of pipe fittings on hand at any mine with a length



Self-oiling Roller

of round soft steel or wrought iron either machined or in the rough, for an axle.

The rollers in use here are made up of a 6-in. length of 2-in. pipe; two reducers, 2 in. to 1 in.; two faced-bushings reducing 1 in. to ½ in., reamed to depth of thread; and, for axles, soft steel turned to the inside diameter of the bushings. The roller is made self-oiling by filling with oil-saturated waste. The ends of the axle may be fastened rigidly to bearers or may be set in bearings and allowed to rotate with the rest of the roller. An axle of greater diameter may be used, turning down the ends only and leaving shoulders to bear against the inside faces of the bushings; this will prevent any sidewise movement of the roller. With proper combination of fittings any size roller can be made. Malleable-iron fittings are better than cast-iron.

*Superintendent, New England & Clifton Copper Company, Clifton, Ariz.

A Portable Winch

A portable winch is an extremely useful piece of machinery at any mining operation. At the Republic mine, Republic, Mich., an ordinary hand winch is mounted upon a heavy frame which in turn is mounted upon trucks for a standard-gage track. A 7½-h.p. electric motor is also mounted on the same frame and connected by belt to the pinion shaft which operates the drum. A friction clutch is used to throw the drum in gear. This winch can be moved to any point where there is a car track and is easily anchored by fastening to the rails, or by means of chains to stakes in the ground. Where electric power is available, this arrangement is quite satisfactory, as power can be obtained from any point along the line. The entire apparatus is not so heavy but that it can be moved over smooth ground without the aid of rails. This one is used where a temporary hoist is required, and also in the erection of trestles for car tracks on stock piles.

A Use for Old Boiler Tubes

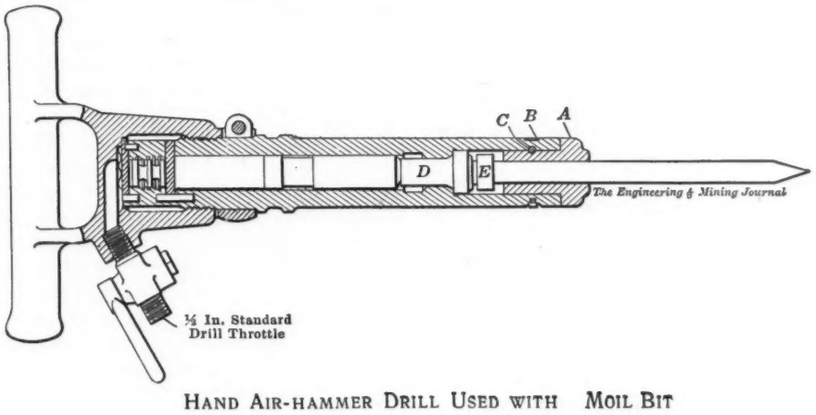
At one of the mines in Michigan the superintendent built a fence around his office in which he utilized a large number of old boiler tubes which had been discarded from the steam plant. Later on a delegation of the directors and owners of the property visited the mine and in a pleasant way reminded him that such fences were expensive when using 3-in. tubing that could be used for other purposes. The directors, however, did not know that the superintendent had utilized waste material in building his fence. Upon informing the directors that such was the case the manager was complimented upon making use of scrap material.

In using boiler tubes for fences about the only work required is cutting off the broken ends, and making all the tubes of uniform length. The posts need only be of ordinary size—large enough to be bored to receive the tubes.

An Air Moil for Cutting Timber Hitches.

By S. H. Hill*

In the Lake Superior district it has been customary to cut the hitches required in timbering by hand, usually with a moil. However, since a great number of first-class air-hammer drills have come upon the market the use of an air moil for this work has met with favor upon the grounds of economy and speed. The air moil can, of course, only be used in headings that are piped for air. A reducer can be used on the end of the pipe and air for the hand tool taken from the nipple used for heading machines. However, this necessitates doing the hitch cutting or squaring when the heading machines are not in use or while one of them has been purposely stopped. The introduction of a manifold on the end of air pipe, having one opening especially for the hand tool is more satisfactory.



Hand Air-hammer Drill Used with Moil Bit

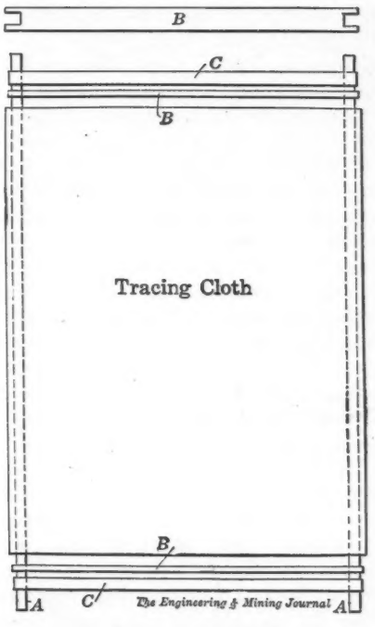
A standard tool, such as shown in the accompanying illustration, of the Hornet hand hammer drill manufactured by the Ingersoll-Rand Company, is used for this work. The hand drills now on the market vary in weight from 20 lb. up. The bushing *A* for the drill steel is removable from the cylinder upon the removal of dowel pin *C*, which is held in place by snap spring *B*. As is seen, quite a recess is afforded between the rear end of the bushing *A* and the front end of anvil block *D*. In practice, steel of proper form to fit whatever bushing the drill is equipped with, is used. One end of this steel is shaped into a moil bit(which at no place can exceed the diameter of the steel itself) and the other end upset in such a way that it will ride easily in the recess between the bushing and anvil block, and at the same time the steel will be prevented from being shot from the drill in case the moil is not tight against the ground. The moil can be removed from the hammer drill by removing snap spring *B*, dowel pin *C* and pulling out both the moil and bushing. The bushing can then be taken from the moil by simply slipping it over the point. The use of the above-described contrivance means a saving of time. There is also a possibility of making use of this outfit in sampling breasts, etc.

*218 Providence building, Duluth, Minn.

Illuminating Screen for Underground Surveying

By Lee Fraser*

For illuminating the point of sight in underground surveying, it is customary to place the light behind the bob, interposing a transparent paper or tracing cloth. For preserving the paper or cloth in good condition, and in a manner convenient for ready use, the simple device shown in the accompanying figure gives excellent satisfaction.



Screen for Illuminating Plumb Line

The tracing cloth or paper is wound on one of the round rollers *A*, and then wound back on the other for a short distance; the dividers *B* are inserted as shown and the frame held together by two rubber bands *C*. When one portion of the cloth becomes soiled it may easily be rolled off and replaced by a clean section For convenience in carrying, the dividers may be removed and the screen rolled up and placed in a metal tube.

The Southern Power Company, of Charlotte, N. C., will build an experimental plant for the manufacture of air-nitrate fertilizers.

*Mining engineer, Boston mine, Puntarenas, Costa Rica, C. A.

Canal Zone Meeting of American Institute

SPECIAL CORRESPONDENCE

The steamer "Prinz August Wilhelm," with the excursion party of the American Institute of Mining Engineers, returned to New York Nov. 16, the trip having been carried out in a way most satisfactory to those who joined in it. The stay on the Isthmus of Panama was long enough to give opportunity for a thorough examination of the canal works.

As noted in the JOURNAL last week, the party arrived in Colon on the morning of Tuesday, Nov. 1, and was received by Col. George W. Goethals, Lt. Col. H. F. Hodges, Lt. Col. D. D. Gaillard, Lt. Col. William L. Sibert, Civil Engineer H. H. Rousseau, Maj. Eugene T. Wilson, and others of the staff. After luncheon on the steamer the party proceeded by special train direct to the Tivoli hotel, at Ancon, on the Pacific side of the Isthmus, arriving late in the afternoon. The rain which had threatened all morning obligingly held aloft until after the train had started and the shower was over before arrival at Ancon. The hotel proved a delightful surprise; modern in every respect, rooms large, airy and cool, private baths, large ball room, billiard room, etc. Also and equally to the point, the cuisine was excellent in every respect.

On Wednesday, Nov. 2, a special train took the travelers through the Culebra cut, nine miles long. All branches of excavation and transportation were studied: Churn and air drilling; steam-shovel work; loading and unloading cars. In the afternoon a reception was given the members by President Arosamena, of the Republic of Panama.

INDEPENDENCE DAY

Nov. 3 was the seventh anniversary of the independence of the republic and was observed as a public holiday. A trip was made to Culebra for study of models of the Gatun and Piedro Miguel dams and locks. In the city of Panama there were masquerades, fireworks, etc. President Arosamena gave a public reception in the afternoon, and in the evening the entire party was the guest of W. L. Sanders at the Nacional theater, where the "Merry Widow" was given in Spanish.

The following day the locks and dam at Piedro Miguel and Miraflores were inspected as was also the western half of the relocated line of the Panama railroad. In the afternoon an excursion was made by train and tug to the western end of the canal. The fifth session of the institute was held at the Tivoli hotel that evening, when Col. W. C. Gorgas gave a talk on the work of the sanitation department of the Isthmus, followed by W. P. Hayes, of Washington, on the geology of the Isthmus, and illustrated lectures on the diamond and gold mines of the Rand, by Gardner F. Williams.

VISIT TO THE ISLAND OF TABOGA

On Saturday, Nov. 5, a train and tug excursion was made to the island of Taboga, 11 miles across the bay from Balboa, and of both scenic and historic interest. The climate of the island is most salubrious, and the large sanitarium erected by the French is still used as a health retreat for the employees of the Isthmus. The ancient and quaint village on the island was visited and a special call was made to the historic church of San Pedro, where Balboa attended mass on one of his journeys to the Pacific. Many of the party enjoyed a swim in the warm waters of the Pacific, and then followed a hearty luncheon at the sanitarium. To illustrate the salubriousness of the island, there the sun shone brightly, the air was balmy, almost crisp; yet on the mainland—11 miles away—the hills and mountains were enshrouded with heavy clouds and rain seemed to be falling everywhere. The party returned by steamer to Balboa, just after the rain had ceased; thence to the quarry on Ancon hill, which was viewed with interest. The No. 12 gyratory crusher seemed to appreciate its duties and was devouring rock at the rate of 400 tons per hour. The day closed with a reception, dance and collation at the Tivoli hotel, under the auspices of the Institute party.

On Sunday, the party attended services at St. Luke's church, followed by an interesting visit to the hospital, on the invitation of Colonel Gorgas and his assistants. The afternoon was spent in various ways, according to individual tastes; driving in the Sabana country, viewing the excellent set of official photographs at the hotel, visiting important places in Panama, etc.

The sixth session of the institute was held in the evening at the Tivoli, and the following papers, illustrated by lantern slides, were presented by the authors:

"Recent Development in the Undercutting of Coal by Machinery," by Edward W. Parker; "The Manufacture of Electrical Mining Machinery," by David B. Rushmore; "A Popular Lecture on South Africa, Including Its Big Game," by Gardner F. Williams.

On Monday, Nov. 7, the party took a special train over the eastern half of the relocation of the Panama Railroad to Gatun. It rained heavily while on the train—3.28 in. in 59 min. Fortunately, the rain ceased before the train reached Gatun. The imposing dam and spillway were visited and studied. Luncheon was taken at the department hotel at Gatun. In the afternoon the locks were studied in detail, light rain falling for a few moments only.

THE START FOR HOME

On Tuesday, Nov. 8, the party returned to the steamer which left Colon at noon. The following day the seventh session of the institute was held, the topic being the canal. On Nov. 10, the steamer arrived at Kingston, where a morning was spent ashore. D. W. Brunton entertained the party at luncheon at the Hotel Myrtle Bank.

On Friday the eighth session was held and on Saturday the ninth. At these meetings were presented, "The Development of Water Power in Montana, and the Electrical Pneumatic Hoisting Plant for the Mines of the Anaconda Company at Butte," by C. W. Goodale; "Conservation in the Preparation of Anthracite for the Market," by W. S. Ayres; "Report of the Delegates of the Institute Attending the Convention of the American Mining Congress at Los Angeles," by D. W. Brunton; and "The Report of the Committee on Uniform Mining Laws for the Prevention of Accidents to Miners."

COMMUNICATING WITH THE PRESIDENT

Late on the night of Nov. 11, on the return trip, the steamer passed within about five miles of the cruiser "Tennessee," on its way to Colon with President Taft and his party on board. Advantage was taken of this to send the following message by wireless telegraph to the President:

"American mining engineers returning from the Isthmus congratulate you upon good plan, splendid management and satisfactory condition of work."

This message was duly received and the President sent the following answer:

"Your message received. It is most satisfactory to have assurance of men who are experts that the great canal construction has been well planned and is being carried on to successful completion. I thank you and your associates for your visit and the courtesy of your kind message."

On Sunday, Nov. 13, Doctor Raymond conducted services in the morning, and in the afternoon R. P. Porter gave an informal talk on South America. On Monday afternoon resolutions of commendation for the canal work were adopted, and a paper presented by Prof. J. W. Richards on "The Manufacture and Refining of Steel in the Electric Furnace."

The Canal Resolutions

On Nov. 14 a meeting was held on the steamer, at which the following resolutions were adopted, and signed by all the members of the party:

"We, the undersigned, members and guests of the American Institute of Mining Engineers, after a visit to the Isthmus of Panama, and inspection of the work of the United States Isthmian Canal Commission, and after full discussion of our individual impressions, find ourselves in unanimous agreement as to the following conclusions:

"(1). The present plan of the work is clearly practicable, and the best in our judgment that could be devised under the conditions imposed. It is perhaps a question whether by the choice of a higher level some of the difficulties and uncertainties of excavation in the Culebra cut might not have been minimized; but a higher level has its disadvantages also; and no one seriously proposes such a plan. On the other hand, we are convinced that a canal at a lower level, and especially at sea-level, is practically out of the question; that no man can estimate its cost, or even guarantee its satisfactory completion and maintenance at any cost. We are satisfied that the sea-level canal, as proposed, if actually completed, would be inferior to the present lock canal, by reason of its necessarily narrow and tortuous channel, its liability to many disturbances from which the lock canal is comparatively free, etc. The experience gained in the Culebra cut throws additional light upon the sea-level plan, and renders that scheme less worthy of approval by engineers than it was when with less information some eminent authorities favored it. In a word, we do not think that any prudent engineer would now recommend the deepening of the Culebra cut below the level now fixed for it.

"The creation of the great Gatun lake by means of the Gatun dam seems to us to be the best possible way of dealing with the floods of the Chagres and other streams. The location of the Gatun dam, spillway and locks is singularly favorable for such constructions; and there is, in our judgment, no reason for any anxiety as to their stability.

"The one serious remaining problem is presented by the nature of the ground in the Culebra cut. There have been extensive slides on the sides of this excavation, and more of them are to be expected; but they involve nothing more than the cost and delay of removing the material which they will force into the cut. They will ultimately end, and we regard as reasonable the calculation of the engineers in charge as to the time and money which they may call for. The results of these calculations are included in the estimates of the commission as to the cost of the canal and the date of its completion.

"(2) We are unanimous in our praise of the manner in which sanitation, excavation, transportation and construction are performed with rapidity, skill and economy. A spirit of loyalty, emulation, industry and pride seems to animate employees and officers alike. This spirit, so difficult to arouse among workers in tropical climates, is due in this case to two causes: First, the inspiring example of Colonel Goethals and his associates, and secondly, the splendid work of the sanitation department under Colonel Gorgas. The cities of Panama and Colon, though politically outside of the Canal Zone, have shared in the benefits of the sanitary administration, and reflect an unwonted cleanliness, comfort and safety.

"(3) We acknowledge the entire freedom and fullness with which everything we desired to see was shown to us, and everything we desired to know was told us, by the officers of the commission. There was evidently no wish to withhold or conceal anything. On the contrary, inquiry and criticism were frankly sought and heartily welcomed.

"This is but a meager summary of the points on which we are agreed. The details of individual opinion will appear later in the published report of our discussions. Meanwhile, we unite in this common declaration, which covers our conclusions on all main points. We think the present plan of the canal is good; that the work is in thoroughly capable hands; that it is progressing satisfactorily, and that it will be completed by the date set for it, Jan. 1, 1915, and probably earlier, provided Colonel Goethals and his associates receive the hearty support of the American people, and its representatives in Congress. The canal engineers are the right men in the right place. The great work in which they are engaged is not connected with partisan politics, and citizens of all parties should combine to secure its early and triumphant completion. In that consummation every American should take greater pride than in any victory of military or political conflict."

Land was sighted on Tuesday, Nov. 15, and at 6:15 p.m. the landing was made in New York. Doctor Raymond, secretary of the institute, said:

"Of the many journeys of social and esthetic pleasure and professional instruction—to Mexico, Pacific coast, British Columbia and the Yukon Territory, Ontario, Quebec, Nova Scotia and Prince Edward island, England and Scotland, Germany, etc.—not one surpassed in technical interest, or equalled in completeness of success, this excursion to the Canal Zone."

Papers Presented

The papers presented during the first three sessions of the Canal Zone meeting of the American Institute of Mining Engineers were listed in the JOURNAL of Nov. 19. Beginning with the fourth session, held on Oct. 31, the following papers were read and discussed:

History and Construction of the Panama Canal, W. L. Saunders.

Panama and Its People, John M. Sherrerd.

The Work of the Sanitation Department on the Isthmus, Col. W. C. Gorgas.

The Geology of the Isthmus, Willard P. Hayes.

Diamond Mines and Gold Mines of the Rand, Gardner F. Williams.

Recent Development in the Undercutting of Coal by Machinery, Edward W. Parker.

Manufacture of Electric Mining Machinery, D. B. Rushmore.

Lecture on South Africa including its Big Game, Gardner F. Williams.

The Development of Water Power in Montana and the Uses of Electric Power in Pumping, Compressing and Hoisting in the Butte Mines, Chas. W. Goodale.

Conservation in the Preparation of Anthracite for the Market, W. S. Ayres.

Report of the Delegates of the Institute Attending the Convention of the American Mining Congress at Los Angeles, D. W. Brunton.

The following papers were presented either in oral abstract by the secretary or by title only:

Manganese Ore in Unusual Form, W. P. Blake.

Crushing Machines for Cyanide Plants, Mark R. Lamb.

Recent Progress in Blast Roasting, Prof. H. O. Hofman.

The Nicola Valley Coal Field, British Columbia, postscript by Roberts.

Labor Saving Appliances in the Assay Laboratory, Edward Keller.

The Limit in Economy in the Iron Blast Furnace, postscript by N. M. Langdon.

Dry Washing for Placer Gold in Sonora, J. V. Richards.

Method of Determining the Meridian from a Circumpolar Star at any Hour, Eugene R. Rice.

Pyritic Smelting in Leadville, C. H. Doolittle and Royal P. Jarvis.

Recent Developments in the Undercutting of Coal, Edward W. Parker.

The Laws of Intrusion, Blamey Stevens.

Biographical Notice of Franklin R. Carpenter, Prof. H. O. Hofman.

The Reduction of Calcium Sulphate by Carbon Monoxide and Carbon, and the Oxidation of Calcium Sulphide, Prof. H. O. Hofman.

Tests of an Ilgner Electric Hoist, R. R. Seeber.

Bibliography to Accompany Paper on Electric Mine Hoists, D. B. Rushmore and K. A. Pauly.

Biographical Notice of William Phipps Blake, Dr. R. W. Raymond.

Copper Blast Furnace Tops, N. H. Emmons.

Report of the Committee on Uniform Mining Laws for Prevention of Mine Accidents, W. R. Ingalls, J. Parke Channing, James Douglas, J. R. Finlay and John Hays Hammond.

Mine Survey Notes, George W. Riter.

The Solid Non-Metallic Impurities in Steel, H. Hibbard.

Theory of Dust Explosions, Audley H. Stow.

The Gold Fields of French Guiana, and the New Method of Dredging, Albert F. Bordeaux.

The Agency of Manganese in the Superficial Alteration and Secondary Enrichment of Gold Deposits in the United States, W. H. Emmons.

A Commercial Fuel-Briquet Plant, discussion, C. T. Macolmson.

Genesis of the Leadville Ore Deposits, discussion, Norton Webb.

Introduction of the Thomas Basic Steel Process in the United States, discussion Hibbard.

The Combustion of Carbon, discussion, Prof. William Kent.

Calculation of Sinking Funds, discussion, Frank Firmstone.

A Commercial Fuel-Briquet Plant, discussion, Robert Schorr.

Combustion in Cement Burning, discussion, Robert Schorr.

Crushing Machines for Cyanide Plants, Herbert A. McGraw.

Recent Progress in Blast Roasting, James W. Neill.

Geology of Silver Fields of Nipissing, Ontario, Reginald Hore.

Richmond-Eureka Mining Company

In a report issued Nov. 9, 1910, to the stockholders of the Richmond-Eureka Mining Company, Ruby Hill, Nev., President Albert Fries states that since the organization of the company all the details for the acquisition and transfer of the Eureka Consolidated and Richmond companies have been perfected.

The shafts have been retimbered, old drifts cleaned out and the best machinery and pumps installed. Several buildings for the employees, as well as for offices, have been built and a railroad to the mine at Ruby Hill has been constructed.

From Jan. 1, 1908, to July 5, 1908, operations were entirely suspended, owing to the closing down of the Salt Lake smelteries awaiting the outcome of the "smoke nuisance" litigation. Since that period the company has operated at a profit, paying off all debts incurred during the enforced idleness, and at present has a surplus. There was a shutdown during February, 1910, when several miles of the Eureka & Palisade railway were washed away. About $900,000 have been expended during the last five years. Besides having several years' supply of ore above the water level, there is a plant ready to start operations as soon as the railroad connections are completed, which should be within 60 or 90 days.

Public Schools on the Mesabi Range, Minnesota

SPECIAL CORRESPONDENCE

No mining communities in America have a more difficult problem than that of the education of the school children on the Mesabi range of northern Minnesota. This is accounted for by the tremendously rapid growth in school population; the heterogeneous character and polyglot nature of the children crowding for attendance; the prejudices of both children and parents born of generations of religious, monarchical and class misrule and oppression; and the ignorance of the English language and misconception of the American principles of government and control.

A concrete example of this difficulty and the way it is met is in the Hibbing school district. Last year Hibbing did not have schools enough, although it had been building public school structures at the rate of from $50,000 to $75,000 per year for some time. The district embraces an area that has, roughly speaking, 1½ miles radius. During that year it was paying $300 a month for the use of conveyances for bringing children from the outlying sections to the central schools. During this season it has built seven well equipped buildings in these outlying settlements at a cost of about $90,0000, and six of these are now occupied. Notwithstanding this, there are only 52 pupils less enrolled in the central schools than a year ago. No such unprecedented growth was to be expected in a year when the mining business of the district was somewhat slow.

A recent compilation of statistics shows these children to be representative of no less than 27 distinct countries. They come from Servia and Montenegro to Lapland, from Japan to Iceland, and when they enter the public schools the majority of them cannot speak any language but their own, other than a few words of English picked up on the streets and not always of the best moral tone, or the highest character.

These children come from countries and homes where the attitude of the poor has been either absolute or negative opposition to all authority, as a prerogative of despotism. Their understanding of government is that it means persecution, and their translation of the word freedom is merely unrestrained and individual license. It is the first duty of the teachers to relieve the minds of both parents and children of their misconception of authority, and what is even more difficult —to show them that the liberty of America is based on a proper respect for the rights of others.

MODERN SCHOOL BUILDINGS

The Hibbing school district is especially fortunate in having a vast taxable valuation. Last year this was no less than $89,842,000. With such a fund back of its tax levies the district is able to do much that less fortunate districts are unable to accomplish. The school buildings are fitted with complete systems of forced ventilation. They have the most modern sanitary arrangements. They are fitted with lunch rooms, and ample bathing facilities, with male and female attendants. The grounds are large and are equipped with all necessary exercising apparatus, and often indoor gymnasiums for inclement weather. Physicians are constantly on the lookout for both those diseases incident to childhood and those apt to be imported from foreign countries. There are thorough courses in manual training and domestic science, and night schools for the lads at work. Nothing is left undone to inculcate patriotism, a desire for cleanliness and a knowledge of the spirit of American institutions.

The problems of school management in these mining towns are many and hard, and at times curious, often laughable. The suggestion that a child bathe at the school is often met with the indignant response that he is "sewed up for the winter," which is literally true. "Johnny is no violet, don't smell him, learn him," was the caustic note sent by one mother in response to a remark by the teacher that the youngster had more about him than was necessary. It is hard to get the confidence of these children, and even harder to get that of their guardians. When this is once done the rest is comparatively easy.

These schools are making American citizens out of the most unpromising material, and their work is of extreme importance to the future of the State and community.

Petroleum in Illinois

The State Geological Survey of Illinois reports the following official figures for the petroleum production of that State in 1909, the amounts being stated in barrels:

January	2,668,607
February	2,510,548
March	2,757,794
April	2,562,215
May	2,829,277
June	2,670,549
July	2,728,857
August	2,719,958
September	1,902,197
October	2,560,072
November	2,497,847
December	2,490,418
Total	30,898,339

The production for the last third of the year is over a million barrels below either of the other four-month periods.

Tin Mining and Milling in the Bolivian Andes

Crude Methods Employed. Mines Gophered. Operations Conducted at 14,000 to 18,000 ft. above Sea Level. Only Rich Ores Workable

BY GEORGE W. DEAN*

Although Bolivia has for years been accounted among the tin-producing countries of the world, this industry may be said to be yet in its infancy there, and it is only because of its rich deposits that the present production of something like 20,000 tons annually has been possible. The methods employed in general are crude and in even the larger mills the losses are high and preclude the working of any except high-grade ores.

This has led to a system of gophering, and but few mines can be said to be properly laid out and developed, and fewer still have any large ore reserves blocked out. This is especially true of the small properties which are operated with hand plants, as in the majority of cases the owner contracts with natives to deliver concentrates of a certain grade for a stated price and often does not know where the *pilqueñero* obtains his ore. As a result, only the rich surface ore is taken out and this without any definite system, so that, although the property may have been producing tin for years, it is absolutely undeveloped and can only be classed as a prospect.

Wherever the *pilqueñero* finds the ore, he follows it in whatever direction it may take until it pinches out and then deserts the place and hunts some other promising locality. As a result, his work is practically valueless as a basis for future development work or to determine the value of the property as it stands. The work is done with hammer and drill, and dynamite, in the ordinary manner, but a pick is never used to take down the loose ground, its place being supplied by a gad or *cuña*, and short bars.

*Consulting engineer, Pan-American Tin Company, St. Louis, Mo.

Natives Hand Pick and Then Concentrate

The ore is carried to the surface in cowhide bags slung on the backs of the miners, there broken by hand to the size of a hickory nut, the richest sorted out for concentration and carried to the nearest water, where it is ground and washed. The grinding is done by means of iron or stone *quimbaletes*, usually on a stone pavement but sometimes on a sheet of boiler iron, to about one-eighth or one-quarter inch, screened and the oversize jigged on hand jigs. Where the ore is free from sulphides, this gives a clean product which is dried and sacked; otherwise it is reground to about 10-mesh, combined with the undersize from the first crushing, and washed in *cajones*, which are simply small trenches in the ground with an inclined floor of a compact turf, called *cohija* by the Indians. A few pounds of the crushed ore is placed on this and a thin sheet of water allowed to flow over it, the ore meanwhile being mixed and raked from side to side with small wooden paddles.

In some instances the fines are washed on ordinary square buddles and the slimes on round concrete buddles. The washing is repeated until the concentrates are of sufficiently high grade, when they are usually "kieved" and dried. The last operation in the concentration is called *venteando*, and consists in pouring the dried concentrates from a hight of 4 to 6 ft. upon a sheet of canvas while a moderate breeze is blowing. The wind carries the lighter particles to one side, where they are gathered up and rewashed, the concentrates being sacked for shipment. The washing is usually done by women who become expert in judging the grade of the concentrates, from 400 to 800 lb. of crude ore being the usual capacity of a *cajon* per day of 10 hours.

Transportation by Llamas

The ore is sacked in weights of 50, 75 and 100 lb., depending on whether the transportation to the railroads is to be done by llamas, burros or mules, the regulation cargoes being 50, 150 and 300 lb. respectively. In many places this work is done almost exclusively by llamas.

In some places a combination system of hand and machinery is used, the richer ore being concentrated by hand and the lower grade sent to the mill. The ore is brought down from the tunnels of the Churuimani tin mine by six small aërial tramways to a central station where the richest ore is sorted out and the balance is transported to the mill by another rope tramway. The mill consists of a Huntington mill and two tables and with the hand plant produces about 20 quintals per week of 65 per cent. concentrates.

Crushing in the Quimbalete

A Llama Pack Train

Buddles Can Only Work Eight Hours Daily because of Cold

The Milluni-Huayna Potosi is a comparatively modern mill of 40 tons capacity, consisting of a Blake crusher, air-cushion stamp and eight Wilfley tables with a few small buddles outside. The buddles can only be used from about nine in the morning until five o'clock in the afternoon on account of freezing.

The ore worked here averages 3 per cent., and, as far as I have been able to determine, is the lowest-grade ore milled in Bolivia. The losses are

high and the tailings are reserved and reconcentrated. During three months of the year they have insufficient water power for crushing, and for several months have only enough power to crush for half the time, and it is during this time that the tailings are reconcentrated. The ore contains considerable sulphides and all concentrates are roasted and "kieved" before shipping.

Among the larger plants the Avacaya mill, near Pazña, in the department of Oruro, will, perhaps, best serve as typical of the methods in use in Bolivia. This is the property of a Chilean company and is said to be one of the best-paying concerns in the country. The mill is situated about 3 km. from the mine and about 1500 ft. lower. The ore is transported to the mill by an aërial tramway of the English type, with buckets carrying 300 lb., and dumped into an open bin built into the side of the hill.

Indian Boy Conveyer

The plant is really two separate mills which are operated independently of each other, except that they are driven from the same engine. On one side, the ore is wheeled from the bins in wheelbarrows and fed by hand into two batteries of five stamps each, the feed ranging in size up to 3 and 4 in. in dia. Here it is crushed through an 18-mesh screen and passed over a crude classifier, the sands going to a trommel and the fines to round concave buddles 16 ft. in dia. The oversize from the trommel is fed by hand to a two-compartment Hartz jig, yielding concentrates of 58 per cent., tailings which are discarded, and middlings which are carried up three flights of stairs by Indian boys and returned to the battery. The buddles yield three products, the tailings being discarded, the middlings returned to the same buddle for rewashing, and the heads taken to other buddles where they are reconcentrated two or three times, kieved, dried and sacked for shipment, often assaying as high as 70 per cent. tin.

Vanners Used after Jigs without Settling

On the other side, the ore is fed by hand into two 60-in. ball mills, where it is crushed through 18-mesh screens and falls into a launder and is carried by a stream of water and without any intermediate sizing to a two-compartment Hartz jig which yields two products, viz: Concentrates of 64 per cent. and tailings. The whole discharge of the jig is carried to six Frue vanners without any preliminary settling or sizing. As a result, the vanners are flooded with water and practically everything is flushed off. No washwater is being fed to these vanners and they are producing only from 80 to 100 lb. of 60 per cent. concentrates *per diem*. The tailings from these vanners are led over a two-compartment Hartz fine jig which yields 100 to 150 lb. of 74 per cent. concentrates per 24 hours!

At the time of my visit, August, 1908, they were installing a slime plant to treat the tailings, consisting of a chilean mill, three Frue vanners and three tables. The average grade of ore being fed to the mill varies from 9 per cent. to 17 per cent.; the mine-run of about 5 per cent. is hand picked at the mouth of the shaft to that grade. From the foregoing it will readily be seen why low-grade ores cannot be concentrated at a profit under existing conditions.

In general, the ores now being worked are oxidized and carry but little sulphides, but with depth the tin is associated with sulphides of iron, arsenic, antimony and lead, and will render roasting imperative when the oxidized ores have been worked out, and trained millmen

The Churuimani Tin Mine

will then take the places of the present operators whose only qualifications are "being a good fellow and a relative of the boss."

Tin Placer Mining Also Carried On

Placer mining, while not being followed to any great extent for tin, is occasionally found, and the methods employed here are as crude as can well be imagined. Operations are carried on at the Villa-Aqui placer mine, situated about 10 miles from La Paz and connected thereto by a road over which an automobile may be driven. The gravel carries tin, gold and bismuth, but is at present being worked only for tin. Here the Indians lead the stream through a ditch on one side and then dig a pit in the bed of the stream to bed rock, which is usually from 3 to 4 ft. below the level of the stream. As the water filters into the excavation, it is splashed against the side of the bank with a shovel for a few minutes and then bailed out. They then pick out the larger pieces of tin ore with their fingers and shovel up the finer portion and wash it in a wooden *batea*, nothing finer than about 8-mesh being saved. In a series of samples taken from different parts of this property, I found that the principal part of the tin values were 10-mesh and under. All of this is lost in the present method employed, and it speaks well for the property, to say the least, that it can be worked in such a manner. The concentrates obtained vary in size from fine gravel up to pieces of several pounds in weight and in a few instances boulders have been found weighing 100 lb. or over. The larger pieces are usually of comparatively low grade and are crushed with a *quimbalete* and washed, the finished concentrate assaying from 55 to 60 per cent.

In some of the large properties, notably the Concordia mine of the Andes Tin Company, of Boston, the development has been carried out systematically and this property has ore reserves blocked out sufficient to last for years and a modern mill of 50 tons capacity is now being installed. This is also true of a few prospects and smaller properties; for instance, the Pan American Tin Company's property in the region of Chacaltaya.

High Altitude Bars Compressed Air

The extremely high altitude in which tin occurs, usually between 14,000 and 18,000 ft., makes operations difficult, as none but natives can work at this altitude and native labor is, at best, of a very poor quality. Owing to the high cost of transportation and the scarcity of fuel, any other than water power is impractical except near the railroads and the use of compressed air has met with only indifferent success on account of the rarity of the atmosphere at this altitude.

Foreign capital is rapidly becoming interested in mines, not only of tin, but also copper and gold, and the opening of new districts and bettering of transportation facilities will cause a steady and increasing demand for engineers and trained millmen.

Lumber Operations of the Anaconda Company

A large lumber dealer in the Northwest is reported as saying that the Anaconda Copper Company makes on an average $600,000 per annum from its lumber operations, and has 100,000,000 ft. of cut lumber on hand today. It cuts about 160,000,000 ft. per annum. He estimates that on a conservative basis, the Anaconda company's lumber properties are worth $25,000,000 as they stand today.

Prospecting Disseminated Copper Ore Deposits

Lack of Surface Indications; Porphyry Coppers Apparently Confined to Arid Regions. Study of Geological Conditions an Essential Feature

BY CHARLES R. KEYES*

For several reasons the porphyry coppers, or disseminated copper ores, as it is preferable to call them, are claiming wide attention at the present time. In the first place, ore deposits of this class promise to furnish a large part of the world's supply of copper. Secondly, the intense desire to add to the few known deposits of this kind in which active operations are now going on, is accompanied by extreme difficulties, because of the fact that all ordinary experience in prospecting and exploration seems to be of no avail whatever; the time-honored methods do not in any manner apply. A third reason is that for each locality the conditions of occurrence vary more or less, and strictly geologic observations must be largely depended upon. With the most inviting field of porphyry coppers, we are confronted with the necessity of devising new methods of prospecting and exploration.

Usual Surface Indications Lacking

Quite anomalous to the average miner is the occurrence of the disseminated copper ores. They cannot be prospected at the surface of the ground. The ore blanket is deep. In fact, none of the usual surface indications of ore appear to greet the old-time prospector. The few great deposits of this type, which are already opened up, were discovered through the previous working of high-grade, but more limited orebodies. It now seems probable that there are many deposits of disseminated character. In the near future they may prove to be the main class of ores generally to be developed.

Detailed Geologic Study Essential

In the search for new disseminated copper deposits all ordinary prospecting methods are not only out of the question, but promiscuous drilling is sharply delimited by expense. The location of probable deposits must rest largely, if not entirely, upon the results of special geologic inquiry. In the case of the porphyry coppers, this happens to be especially adaptable. With the formulation of certain additional criteria, the geologic method could soon be made, even in comparatively inexperienced hands, the most perfect and sure of all prospecting methods yet devised. Not only is favorable ground for drilling operations pointed out, but ground that should yield immediate returns.

Since it has come to be realized that the porhpyry coppers are to form our most important sources of the red metal, their geologic occurrence assumes first place in their consideration.

Desert Regions Favorable for Blanket Formations

It is characteristic of arid regions of the globe, that localization of the ore deposits of this class is singularly dependent upon well defined climatic peculiarities. In many ways the physical conditions presented by the desert are exceptionally favorable to the formation of extensive ore blankets of disseminated character.

In the desert regions of the United States there are a number of localities yet untouched that offer opportunities fully as favorable for development into important mining properties as has proved to be the cases of Bingham, Morenci, Cananea, Ely, Santa Rita, Spassky, or Braden. These appear to be merely the forerunners of extensive mining exploitations. These developments are probably only the first examples of the prevalent form of the most desired of ore deposits, not only in desert lands, but in other mining regions as well. Under conditions of arid climate these deposits assume unusual dimensions and acquire features which almost render them a distinctive type.

Ground-water Level Low in Arid Regions

Disseminated copper deposits are apparently confined to arid countries mainly because the gossan zone is relatively thick. The ground-water level is usually far below the surface. The space of special enrichment between the zone of thoroughly oxidized ore materials and the zone of profound sulphides is extensive. In humid regions this space is quite thin and frequently so inconspicuous as to be passed actually through without attracting particular notice.

Thus, as a geologic phenomenon, this zone of disseminated copper ore, which is so apparently peculiar to arid lands, is not, in reality, strictly confined to such regions. In desert regions the attendant conditions are such as to make the zone of sulphide enrichment at ground-water level much more extensive than in the other parts of the world. The zone of reduction is even more conspicuous than the zone of oxidation. This zone well merits special designation. Called the zone of "secondary enrichment" by most writers, it is more properly, as A. C. Lawson has suggested, the zone of "Tertiary enrichment." The "bonanza zone" of the Latin-American miners seems a more fitting title.

Immediate Source of the Copper

As to the immediate source of the porphyry coppers and disseminated ores being the metallic sulphides carried in the porphyries themselves, as is commonly assumed, there is grave doubt. Even were the metallic content of the igneous rock amply sufficient for the purpose, there is little question but that there exists circulating with the ground-water currents an abundant amount of the metals in solution to supply the most extensive orebodies. Neither is it necessary to require the presence of primary sulphides of the metals in order to occasion the local secondary enrichment. Silicate minerals in the porphyries are sufficiently abundant to reduce the sulphatic materials coming in contact with them. In fact, ordinary chemical alteration due to weathering of the silicate rock constitutents, seems to be a constant accompaniment of the disseminated ore formation.

The kaolinization of feldspars, for instance, is followed by marked local shrinkage in the volume of the porphyry mass, producing at once both an open texture in the rock and the precipitation of metallic sulphides from the circulating mineralized solutions. Nevertheless, the distinction sometimes made between the occurrence of ore deposits only in the main stock of igneous rock and not in any of its *appanages* whether extrusive flow, dike or intrusive sill, is an important one; but for reasons entirely different from those usually urged. There seems to be close association of disseminated ore blankets with the main body of loccolithic masses.

Open-textured Rock a Fundamental Feature

Open texture of rock mass appears to be a fundamental feature of disseminated ore deposits. Whether this feature is produced in brittle rocks by general shearing strains, due to orogenic movements, local faulting, contraction in volume of the rock mass on account of loss of heat, shrinkage in bulk as the result of chemical alteration of the rock, an important property is that the rocks should be brittle.

Porphyries, quartzite, certain schists,

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and a few limestones preëminently possess the glass like fracturing qualities. Singularly enough the majority of the mountain ranges of arid America are made up principally of just this class of rocks. Owing to the peculiar type of mountain structure prevailing, these desert ranges are also subject to the same tortional strains which give rise not only to close faulting in all of the rocks, but among the brittle rocks to extensive shearing which locally produces typical crushed belts with an open texture.

Margins of Eruptive Masses Especially Favorable

Especially favorable places for the occurrence of porphyry-copper blankets are the margins of laccolites and bosses. This fact is due to a number of circumstances. The rapid cooling of the contact zone of such bodies of magma imparts a characteristic glassy texture to the porphyry and at the same time fractures it more or less finely. Contact margins are also zones of constant slipping, faulting or jointing. Furthermore, major faulting is apt to take place along and near the boundary of eruptive masses. Intense tortional strains in the marginal zone are already mentioned.

So far as ore formation is concerned the most notable result is a marked shattering of the rock. In some places this assumes the character of broad crushed belts, or narrow strips of fault breccia; and in still others a mere dislocation along single planes.

In the open textured belts rapid alteration of the phorphyries takes place in the vadose zone. Sericitization and kaolinization occasion more or less decided shrinkage in the volume of the rock mass, still further breaking up the larger rock blocks. Previous kaolinization may have gone on extensively through hot-spring action during the final solidification of the magma. The open texture is not always confined to the porphyries alone, but often extends into the brittle rocks through which the eruptives force their way.

Points to be Observed in Surface Examination

In the search for the deep lying disseminated coppers, the usual surface indications leading to the discovery of orebodies utterly fail, as already intimated. There are, however, a number of reliable surface clues which, in ordinary prospecting, are not commonly made use of. Of primary importance is the establishment of the proper geologic relationships of the various rock masses. Another factor of prime consideration is exact location of boundary lines between the eruptive mass and the formations through which they break. A point for careful observation is the determination of the broader belts of crushed rock, or breccias, either in shear planes, along fault lines, or in the more limited areas of once intense tortional strains. Data regarding the character and disposition of the ore materials in the high-grade mines, if such there be in the neighborhood, are not to be overlooked. The absence of the ferromagnesian minerals is to be viewed with suspicion. It is to be remembered that little dependence can be placed upon those criteria which are so important in humid countries. Emphasis is to be placed upon the peculiarities of the secular disintegration of rocks under conditions of an arid climate. Other favorable indications might be enumerated.

Exploration of Disseminated Deposits

Exploration of the disseminated ores must remain in a backward state so long as the old methods of prospecting are followed. When the guiding geologic clue to the favorable ground for the disseminated lead ores of Missouri was pointed out, it took more than a decade before it was adopted in practice. Under desert conditions strict adherence to the method is even more essential.

Monazite and Zircon

Minerals containing thorium are in constant demand for use in making incandescent mantles for gas lamps, but only one mineral that carries much thorium—monazite—has thus far been found in quantities large enough to make it commercially valuable. Some specimens of monazite contain as much as 20 per cent. of thorium, but the thorium content of commercial monazite, which has been washed and otherwise cleaned, ranges from 3 to 9 per cent.

Practically all the monazite of commerce is derived from placer or gravel deposits, all attempts to extract it from original rock matrix having failed. The deposits are worked by sluicing and hydraulicking, and the crude monazite sand obtained is further cleaned on concentrating tables and by electro-magnetic machinery, which removes its iron content.

Sources of Monazite

Brazil and the United States supply the world's demand for monazite, although the greater part of the output of the United States is used in this country. For many years North Carolina and South Carolina have furnished this supply, but important deposits have been lately discovered at several places in Idaho.

At one of these deposits, near Centerville, Ida., some trial mining has been done. The gravels worked contain both gold and monazite and the purpose of the experiments has been to devise a method for recovering both.

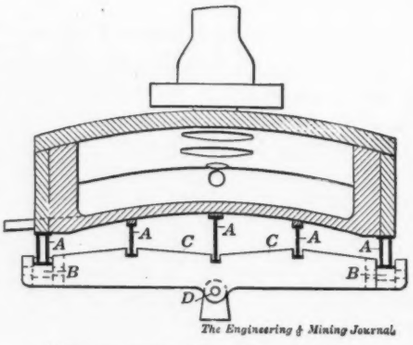
Production

The production of monazite concentrates in the United States in 1909 was 541,931 lb., valued at $65,032, an increase of 119,285 lb. in quantity and of $14,314 in value over 1908, when the production was 422,646 lb., valued at $50,718. The output was all obtained from North Carolina and South Carolina.

A report on the production of monazite and zircon in 1909, prepared by D. B. Sterrett, geologist, has just been published by the U. S. Geological Survey.

Extraction of Tin from Ores and Slags

A. M. S. Robertson, of Aberdeen, Scotland, acting for J. H. Robertson, of 5 Pangkar Road, Penang, S. S., has patented (Brit. Pat. No. 22,140, 1909) a method and furnace for extracting tin and other metals which can be oxidized and volatilized from ores or slags. The extraction is accomplished by employing a slowly rocked furnace, having a convex bed, in conjunction with an oxidizing flame.



Volatilizing Furnace for Tin

Referring to the figure—a cross section of the furnace—the beams *A*, resting on rollers *B*, allow for expansion and contraction. The frame *C* is carried on a central axis *D* at each end and is rocked thereon. The oxidizing flame enters the furnace at one end, and at the other the volatilized oxides from the charge are led off by a duct to settling flues, where the deposits of the oxide can be collected and resmelted into metallic form.

An important feature is the arched top and bed, the latter causing the molten contents to flow from side to side as the furnace is slowly rocked, so that a thin layer is exposed to the flame. The furnace is rocked by threaded rods connected to the frame, the rods being raised and lowered by worm gearing, or other methods of oscillation may be used.

The world's production of metallic aluminum has risen from about 7300 tons in 1900 to 24,200 tons, last year.

The Problem of Fine Grinding in Tube Mills

Best Mills Have Low Efficiency. Product Not Uniform. Many Tube-mill Problems Unanswered. South African Investigators Ahead of American

BY H. W. HARDINGE*

I may justly be accused of having more than a scientific interest in agitating the subject of fine crushing, an accusation to which I willingly plead guilty if it results in aiding the metallurgical profession through awakening a discussion which will result in greater study of the subject. The ignorance which exists among metallurgists in regard to one of their most efficient machines, the tube or pebble mill, is certainly to be deplored. It is generally based upon the supposition that the device is so simple that it is not worthy of much more than the general care given to any other easily understood piece of machinery, needing only careful adjustment. The more we study the device, the more we realize its possibilities. The more we find its deficiencies as we work with it, the more we realize how great is our individual ignorance. The great discovery is that of the existence of this ignorance, and thereby the opportunity opened for research into the complexities of the crushing done in the pebble mill.

Present Tube Mills All Inefficient

In general, it seems we are willing to allow chemical advancement to make rapid strides without giving much attention to the mechanical side of the subject. From my own success in the application of mechanical laws to a partial solution of the problem of fine crushing, I realize the field which is open to the practical investigator. I believe that the machine has not yet been put together which utilizes one-tenth of the possible mechanical efficiency, so great is the waste of energy. The American engineer is inclined to think that he is a little more energetic than the engineers of other countries, but if he will look at the systematic work that is going on in South Africa, he will find he has much to learn in regard to energetic investigation. It is true we are profiting by their successes and failures, but is this a good reason or compensation for the loss of time?

Fine Crushing a Complex Problem

In discussions on the matter of fine crushing, in trying to show the relations of cause and effect, the writers usually refer to textbook formulas on relations of tangential forces to gravity, formulas of liquidity and viscosity of fluids, crushing strains, etc., seldom considering whether the division is due to percussion, compression or attrition. After seeing the elaborate array of figures, one may ask to which pebble of the several thousand do they refer? To which line of pebbles from inner lining to axial center, and which mass, under what conditions of lateral association, quantity and size of material, is being acted upon? Is such material of uniform size or a complex volume—the weight or mass of which is formed of particles which will vary one with its neighbor hundreds of diameters—20-mesh, 100-mesh and 200-mesh, all are crushed under the same conditions and by the same agent.

Our present practice of feeding to the same stamp particles of material ranging from ¼ to 2 in. in diameter is so out of mechanical reason that it should long ago have brought out the tests which are now being made with stamps and tube mills, particularly in South Africa, with the view to improving their efficiency. How much more questionable is the indifference which permits us to crush in the same machine a 20-mesh particle to 200-mesh, where the relation is 1:1000. To crush an 8-in. mass of ore, engineers use a large-sized crusher, and a smaller crusher to reduce the 4-in. cube, a volume relation or reduction of 1:8, yet give no thought of changing the crushing medium when the relation of volumes is 1:1000, as above cited.

Photomicrographs of Quartz. Ground in Tube Mill. (Magnified 170 Diameters)

Tube Mills Require Twice the Theoretical Amount of Power

How many of us have considered why a tube mill half full of pebbles, say 10 tons, making 25 r.p.m., consumes 50 h.p. when all the apparent components of power, such as hight of lift, friction, etc., will theoretically figure only half that consumption? Take from your laboratory a 10-cm. measuring tube, or a narrow beaker; fill it half full of gravel or sand, in which place a bead or other singly distinctive object, close the open end and

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slowly revolve the mass on a horizontal axis; watch your bead in its relation of travel to the inclosing shell of your device and you will probably soon see why the actual consumption of power of your tube mill is double the theoretical amount as first figured. The true crushing efficiency of the tube mill is but a little more than that of a wagon wheel over a sandy road.

The interest taken by the commercial trade, as contrasted with that of the metallurgical, in the matter of fine divisional crushing, has lately been brought to our attention by photomicrographs made by the Michigan Quartz Silica Company, of the product it is producing with an 8-ft. dia. Hardinge conical mill. This is especially interesting in view of the fact that it more or less answers one of the questions I have suggested above, as to whether the crushing was by impact or by attrition. In this case it would appear that the crushing is performed by impact or shattering of the particles. The photomicrograph shows that the fragments are practically all angular or brecciated, presumably along lines of crystallization.

Microscopic Fragments Differ Much in Size

It is also interesting to note that the largest particle shown in this photomicrograph has an actual diameter of less than 200 mesh. Allowing for a reasonable size of thread for the mesh, the actual size of the particle would be even smaller than 200 mesh, presumably 300 to 400 mesh. This crushing has been done dry and is the finished product required as a paint filler and for other commercial uses. A study of this photomicrograph will also show that the associated particles vary in size proportionally as much as the coarser particles produced by the rock crusher and other familiar coarse-crushing devices. This commercial investigation of fine crushing certainly offers a basis for emulation by the metallurgist when it is considered that the commercial product, namely the quartz itself, bears a relation of 100 per cent. of the total while the economic results sought for by the metallurgist, if but $20 per ton, or one ounce in gold, would be about 1/300 of 1 per cent.

Some engineers have been innoculated with a germ similar to that carried by the tsetse fly; it is producing a metallurgical sleeping sickness, a satisfaction with present methods. The germ, like the 200-mesh particle, is microscopic, but the actual basic problem in the industrial-metallurgical field is gigantic. Mining of low-grade ores is making strides far in excess of metallurgical methods; it is being done in thousands instead of tens of tons; values and recoveries are considered in cents per ton rather than dollars. A wide field is opening to the metallurgist; he must adance his methods on a par with his mining brother.

Returns for the Last Half-Year on the Rand

Johannesburg Correspondence

The mining returns for the first six months of 1910 show that the Rand is steadily proceeding with the policy of mining lower-grade ores at a reduced profit per ton. The returns show a larger tonnage of ore mined for a reduced profit per ton and also unfortunately a reduced total profit. During 1909 the profit was $2.87 per ton milled, and for the first six months of 1910 the profit was $2.61 only. Comparing August, 1910, with August, 1909, the value of gold produced was £160,273 greater, but the profit was less by £19,058. During August the mines of the Rand crushed 1,834,105 tons for a total profit of £991,787.

Crushing will not be started on the City Deep until the end of the year and the full tonnage of 65,000 tons per month will probably not be mined until March or April, 1911. It was first anticipated that crushing would be started in October.

Disappointing Developments at the Bantjes Mine

The Bantjes mine started work in August and during August and September crushed 30,199 tons of a screen value of 6.85 dwt. This was below the estimated value of the ore, besides which various troubles were met with in the milling and treatment plant, so the shares fell.

At the same time the announcement was made that the ore developed on the New Kleinfontein mine had not been up to the average and that the grade would have to be reduced. These facts combined with poor development results in the Cloverfield, Van Dyk and other mines have tended to depress the market. Difficulties are also being met with in developing the basin of the far east Rand. The Grootvlei mines in sinking a seven-compartment shaft from 362 to 375 ft. met with a flow of water estimated at 1,700,000 gal. per 24 hours, and sinking has been suspended. The yearly reports have not, on the whole, showed a satisfactory state of affairs.

Nourse Mine Shows Impoverishment

The report of the Nourse mines shows that in 1909 444,700 tons were milled with grade of 7.46 dwt., at a cost of $4.93 per ton, while in 1910 464,600 tons were milled with a grade of 7.34 dwt., at a cost of $5.33 per ton. The ore reserves in 1909 amounted to 2,100,000 tons, at a value of 7.1 dwt., while in 1910, 2,142,000 tons showed a value of only 6.5 dwt.

In the Randfontein Central there are developed 2,400,000 tons, assaying 7.5 dwt. and averaging 30-in. milling width, awaiting the completion of the large 600-stamp mill. Particulars of the record of 279 ft. made in sinking the incline shaft of the Van Ryn Deep in one month show that the shaft was 7½x20 ft. at a dip of 22 per cent. Six 3¼-in. Holman drills were employed, and an average of 30.5 holes 7½ ft. deep were put in per round. This shaft was, I believe, sunk in the somewhat soft shales of the footwall.

Sand Filling in Stopes

In recent notes I have referred to the question of sand filling, and this matter is, at present, engaging much attention. On some mines it has so far proved appallingly expensive. The costs per ton on the Ferreira Deep were 40c., and the mines cannot stand this addition to working costs. The methods used are, however, largely in the experimental stage.

The need of a binding material is being greatly felt and ashes, surface soil and decomposed surface rock have been proposed for this use. Vast tonnages of loose, dry sand in stopes dipping 40 to 50 per cent. might be more troublesome and dangerous than roof falls.

Tungsten Mining in Colorado

Boulder county, Colorado, which produces the greater part of the world's tungsten supply, furnishes an example of the effect that metallurgical progress may have on the profits of the ore producer. The tungsten ores are frequently associated with gold and silver, and are always found in veins.

The problem of late years has been the concentration of the low-grade ores. Practically every known make of concentrator has been tried by the mills, only to fail in saving a fair content of the slime from these ores. Therefore, every concentrating mill but one in the tungsten belt was closed, and in that belt ores were bought on a saving of 70 per cent. Thirty-five per cent. was the best that could be done on the sulpho-telluride and copper-gold ores, and 50 to 60 per cent. saving was good on the lead-silver ores. Therefore, many mines were unable to run and the county was generally regarded as a poor mining field.

According to a recent Colorado School of Mines report, a new development, however, has taken place through the installation of the Monell slime concentrator. On the sulpho-tellurides a saving of 84 per cent. is reported and 15 per cent. has been added to the saving on tungsten. As a result of installing the machines in the Wolf Tongue mill at Nederland, a new schedule has been issued, which raises the price paid for tungsten ore an average of 20 per cent. The Zophar mine has been placed on a paying basis on $6 to $10 sulpho-telluride ore.

The International Smeltery at Tooele, Utah

While much of the information contained in the following description[1] of the International Smelting and Refining Company's new Tooele (Utah) smeltery has already appeared in previous articles, the matter is of fresh interest, owing to the beginning of operations, and to the new illustrations.

The smeltery is on a hillside, which makes it possible to a large extent for the delivery-level of the product of one building to be the charge-floor level of the next succeeding one. Fig. 2 is a general view of the plant from the south, showing the smeltery site, arrangement of buildings, Utah Consolidated tramway terminal, stack, flues, etc., while Fig. 1, the flow sheet, gives a good idea as to the extent which belt conveyers are used in handling ores.

The receiving bins are of steel and are fireproof throughout. They have a capacity of 10,000 tons of ore and coal, and are so arranged that they may be served by the 50-ton electric cars, which deliver ore from the tramway terminal, or by standard railroad cars.

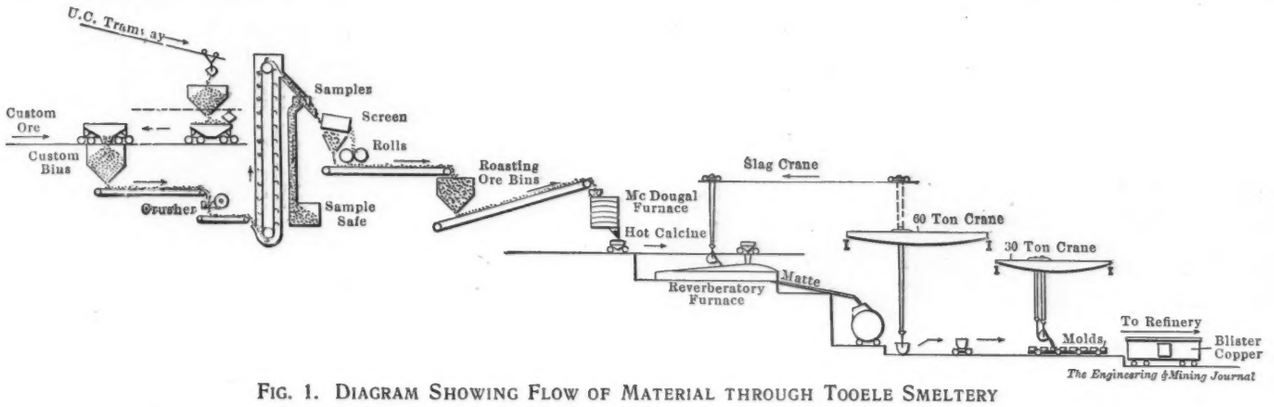

FIG. 1. DIAGRAM SHOWING FLOW OF MATERIAL THROUGH TOOELE SMELTERY

SAMPLE MILL

Ore from the receiving bins is conveyed to the sample mill by belt conveyers, which feed through a shaking grizzly into the crushers. Brunton automatic samplers cut the ore four times, taking one-fifth of the amount each time, and discarding four-fifths, so that of each ton of ore crushed a sample weighing 3.2 lb. is obtained. The ore after being crushed and sampled is conveyed by belt conveyers to the McDougal-roaster steel receiving bins. If it is desired the coarse ore may be conveyed to the blast furnace receiving bin. A blast furnace has not yet been installed, but provision has been made for it. Fig. 3 shows the sampling mill in center, the McDougal bins on the right, the blast-furnace bins on left, also the conveyer housing from the bins to the sampler.

ALL ORE MECHANICALLY WEIGHED

From the roaster ore bins the ore is fed automatically on a belt-conveyer system, which conveys and discharges it into the McDougal-furnace charge hopper. The ore in transit from the bins to the roaster plant passes over a Blake-Denison automatic continuous-weighing and recording machine.

The roaster plant consists of two buildings, each containing 16 McDougal calcining furnaces of the Evans-Klepetko type. After calcining, the ore drops into hoppers immediately over the tracks of the electric-tramming system for transportation to the charge floor of the reverberatory building. No fuel is used other than the sulphur in the crushed ore, which furnishes sufficient heat to do the calcining. The gases are taken through flues into the large brick-and-steel dust chamber. The bottom of this chamber forms a series of hoppers, the contents of which can be drawn into flue-dust cars of the electric tramway system, and conveyed directly to the reverberatory furnaces. Each McDougal furnace has a capacity of 45 tons in 24 hours. Fig. 2 shows the McDougal building and dust chamber in right-center.

WASTE-HEAT BOILERS RECOVER 600 H.P. PER FURNACE

The reverberatory plant consists of three buildings joined together: The reverberatory charge building, containing the ore and coal hoppers over the furnace; the reverberatory furnace building covering a larger part of the furnace, and the boiler house.

Fig. 4 is the south end of the reverberatory building, and Fig. 5 the reverberatory charge-floor. There are five coal-fired reverberatory furnaces, 19x102 ft., with a grate area of 7x16 ft. These furnaces have a maximum capacity of 300 tons of calcines in 24 hours on natural draft. The fuel used is Diamondville coal, shipped from mines in Wyoming, owned by the Washoe Copper Company. The coal is dropped into hoppers which have five points of discharge directly over the firebox. The flame after leaving the furnaces passes through a 746-h.p. Stirling boiler, which reduces the temperature of the gases going to the main flue to about 600 deg. F. By this means, 600 boiler horsepower are obtained from each furnace from the waste heat. The ashes from the furnace firebox fall into hopper cars, and are hauled away to the ash dump. Slag is skimmed from the reverberatories twice in eight hours. It is allowed to accumulate until its depth is from three to four inches above the skimming plate in the front of the furnaces, and then skimmed into slag cars having a capacity of 225 cu.ft., which are hauled to the slag dump over the electric tramming system. The matte is tapped from the side of the furnaces through a copper tap-hole plate, and runs through cast-iron launders directly into the converter building. One of the waste-heat boilers has been equipped with a superheater, which is just at the rear of the boiler. In case it proves satisfactory the other boilers can each be equipped with one.

CONVERTER DEPARTMENT

The converter plant consists of the main converter aisle containing five stands, and the lining department, also the casting shed. The converters are of the horizontal barrel type, and are 96 in. in diameter, and 150 in. in length. They are operated electrically. Fig. 5 shows the first converter being blown. The main aisle is served by a 60-ton electric traveling crane. The casting department is served by a 30-ton electric traveling crane. Matte is received in launders directly from the reverberatory furnaces. The end sections of these launders are

[1]Abstract of a paper read before the Utah Society of Engineers, Sept. 16, 1910, by C. H. Repath and A. G. MacGregor, constructing engineers, International Smelting and Refining Company.

pivoted so that the matte may be poured directly into the converter opposite a reverberatory furnace, or the launder may be turned so that the matte will fall into a ladle, and be transferred by the crane to any of the other converters in the building. The slag from the converters is poured into unlined cast-steel ladles, and transferred to the reverberatory furnaces by means of overhead cranes. There are two of these cranes, each of 12½ tons capacity. The blister copper is poured into a ladle, and transferred by the crane and transfer car to the casting department. The ladle is handled by a crane, and its contents emptied into molds, which completes the operation of producing pig copper.

The converters are lined in the main converter building, but the lining material is prepared in a building adjacent to the ore-crushing plant and receiving bins.

FIG. 2. GENERAL VIEW OF INTERNATIONAL SMELTERY AT TOOELE, UTAH—LOOKING NORTH

FIG. 3. BLAST-FURNACE BINS—SAMPLE MILL—McDOUGAL BINS

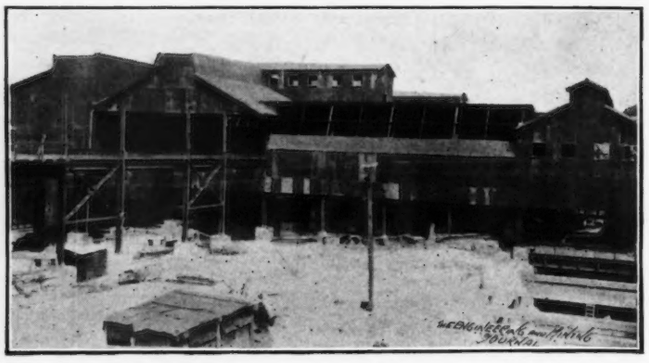

FIG. 4. SOUTH ENTRANCE TO REVERBERATORY BUILDING

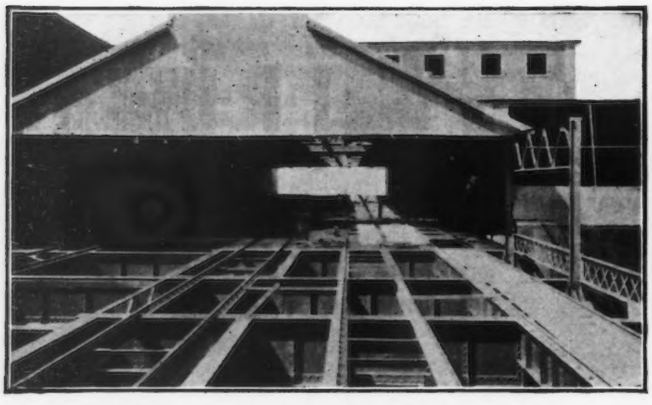

FIG. 5. REVERBERATORY CHARGE FLOOR AT TOOELE, UTAH

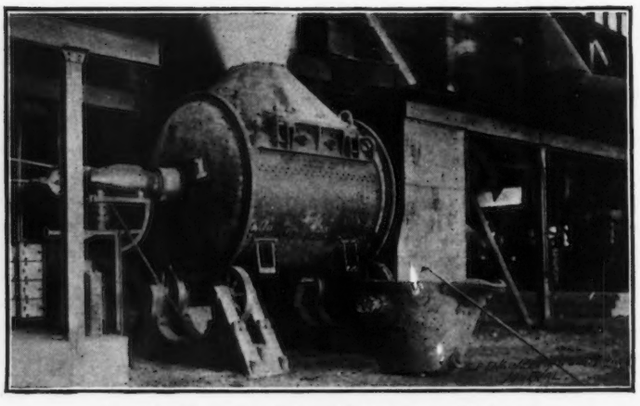

FIG. 6. BLOWING FIRST CONVERTER CHARGE, AUG. 27, 1910

POWER AND TRANSPORTATION EQUIPMENT

The power-plant building is of brick and steel. It has a lean-to for the steam auxiliaries on one side, and an extension on the other side for the switchboard. The building is equipped with an electric crane, and contains various power engines, blowing engines, compressors, generators, etc.

The equipment of the electric tramming system consists of three 7½-ton and two 18-ton electric locomotives, 50 cars of various kinds for handling ore, coal, calcines, flue-dust, ashes and slag. There are about 10 miles of industrial track in the plant. Fig. 7 shows a type of 50-ton ore car which delivers ore from tramway terminals to bins.

The offices are in one end of the building, at the other end of which are the machine, carpenter and electrical shops.

Between the shops and offices are a warehouse, change house and laboratory. The blacksmith and boiler shop is near the machine shop. Adjacent to this is the locomotive shed, which houses the locomotives and spare electric-tramming equipment.

Water Supply

The water for various purposes is obtained from Pine cañon. It is conveyed by gravity from a dam through a 12-in. pipe, approximately 5000 ft. long, to a standpipe of 50,000 gal. capacity at the plant. It is distributed from the standpipe to the various departments. There

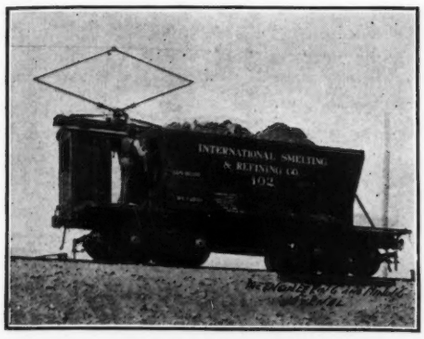

Fig. 7. A 50-ton Self-propelled Ore Car Used at Tooele, Utah

are two tanks having a capacity of 43,900 gal., each so situated that ample pressure is afforded for fire purposes at any part of the grounds. Water is pumped into these tanks from the general supply by the fire pump at the power house.

Lead Poisoning and Sublimed White Lead

By J. I. Blair*

Having noticed that some of the employees around the sublimed lead plant where I was working were less susceptible to the poisonous effects of the lead fume than others, and being unable to get a satisfactory explanation from anyone connected with the plant, I set out to discover the cause of this peculiar state of affairs and also to find which of the three possible ways the fume generally makes its entrance into the system, whether through the skin, the lungs, or by way of the alimentary canal.

In considering the various theories advanced by the more intelligent workmen around the plant, I found that the prevailing idea was to the effect that confirmed drinkers were the only men who became leaded. Having been successful in finding exceptions to this accepted rule I discredited it and decided to begin a systematic search for some data that would clear up the seeming puzzle.

In beginning the investigation I collected all data which seemed to bear on the subject at hand even in a remote manner, including the various reasons entertained by the various victims. Having cast out all data which seemed to be unworthy of further consideration, I next began a classification of the workmen, dividing them into the affected and the unaffected.

Lung and Stomach Trouble not a Cause

In comparing the members of the first class I found that the element common to all was lung and stomach trouble, associated with a weak heart. This causal element, as it seemed, was scarcely perceptible in the second class—those who were not affected, a fact which all but made the seeming cause appear the real. At this stage of my observations I should have been contented to accept this evidence as conclusive proof that only those employees were leaded whose vitality was low, and had not the fact disclosed itself that this cause alone could not account for some cases I had noticed, therefore I was compelled to carry my search further to find the explanation that would cover some rare cases I had found where some men, although in seemingly perfect health, were leaded within a few days after they had begun working at the smeltery. Other instances of exceptions to my newly found rule were in the persons of two men who had followed the work for over fifteen years. Both men were far from being healthy persons, but neither had been leaded in all these years.

To discover the way in which the pigment enters the system I divided the subjects under observation into three classes: (1) Those who only handled the pigment; (2) those who were forced by the nature of their work to breath more or less of the pigment; (3) those who both breathed and handled the pigment.

Under the first class I gathered the painters, grinders, and a few other workmen who handled the pigment in the absence of the fume dust. In these cases the pigment undoubtedly entered the system through the pores of the skin, some, however, was introduced into the alimentary canal by careless handling of tobacco and also by having been smeared on the lips of the men.

White Lead Pigment Cannot Be Washed Off

It is to be noted that it is next to impossible by washing with ordinary soap to remove sublimed white lead when once it has been lodged in the fine wrinkles of the skin. It is this adhesive property that causes the trouble. I have tried personally, as an experiment, with a wash brush and various kinds of soap, to remove the pigment from one of my hands, and after spending enough time and energy to have scrubbed my whole person several times, I found that as soon as the hand was dry I could see plainly the lines of white pigment deep in the wrinkles of the skin. From the fact that the pigment is so difficult to remove, I am led to believe that the skin of the average laborer is never free from the pigment, and that it is great wonder they survive the effects as well as they do.

Pigment Also Enters System by Lungs

In the second class, men were chosen who protected their bodies from the fume, but were compelled to breathe at least a small quantity of it (the best aspirators are not over 90 per cent. efficient in keeping out the dust and fume). These men were bag-shakers and pigment packers. The percentage of men leaded in this group was much less than were leaded in class (1). In this case the pigment must have entered through the lungs as the bodies were always well protected.

The third class was composed of laborers, "yard men," who, owing to the nature of their work were forced to handle and also breathe the pigment. Among this class, as would naturally be expected, the percentage of victims was approximately twice that of either of the other two classes. The fact that they were habitual drinkers or that they partook freely of acid foods such, for instance, as pickles, etc., did not seem to make any difference in the number of the cases or in the severity of the effects of the poison. This last mentioned fact seems to disprove the old idea that vinegar and some other acid foods dissolved the basic lead sulphate in the stomach, thus permitting it to be assimilated by the system.

A New Cleanser Needed for the Skin

Owing to the reticence on the part of the management and to the limited time I had in which to collect my data the subject necessarily suffers under treatment. However, incomplete as it may seem, I believe that sufficient has been shown to indicate that the best remedy is not to be found by improved sanitary conditions around a plant of this character, but should be sought by making experiments to discover some simple, inexpensive but effective method of removing absolutely the last trace of the pigment from the skin. Until this is accomplished there will continue to be a great deal of unnecessary suffering from this source of lead poison.

What has been said of sublimed lead holds also for "blue fume" of the regular lead smelter. The various compounds prepared especially to remove paint, etc., that are on the market, do not meet the requirements.

*Lehigh University, South Bethlehem, Penn.

The Cape to Cairo railroad has now reached Elizabethville, which is the station for the Star of the Congo mine, in the Katanga copperfield.

The Greenawalt Electrolytic Process

Leaching of Ores Followed by Electrolytic Recovery of Copper, Silver and Gold. Regeneration of Solvent by SO_2 from Roasting Ores.

BY WILLIAM E. GREENAWALT*

Various methods of extracting copper from its ores by wet processes have been suggested from time to time. Most of the copper from the Rio Tinto mines, in Spain, has, for generations been extracted by chemical schemes. At Stadtberg, in Westphalia, and at Linz on the Rhine, azurite and malachite ores, containing from 0.5 to 2 per cent. copper, were for a long time successfully treated by leaching methods, in vats holding 90 tons. At one time most of the copper produced in Great Britain from foreign and domestic ores was extracted by solvent processes. The Hunt and Douglas process, devised many years ago, was until recently in continuous operation at Argentine, Kan. There are several mines in the United States where chemical processes are in operation, and at Medzianka, Poland, the copper has been extracted by an electrolytic method for several years. Acid processes, when local conditions were favorable to the cheap production of acid, have added much to the world's supply of copper.

These processes, however, all have defects which are fatal to their extended application. Principal among these is the fact that copper ores almost always contain some silver and gold, and these metals cannot be recovered by any one of the wet methods now in use, and one, and sometimes two, additional treatments are necessary to extract the gold and silver.

Most of the wet methods of extracting copper from its ores which have met with more or less success, have either sulphuric or hydrochloric acid as the basis of the solvent, and it is safe to say that processes which have neither of these acids as the basis, can never hope to find more than limited application.

Disadvantages of Previous Acid Processes

One of the essential difficulties with acid processes has been that the acid is usually too expensive to admit of extended use in mining districts, which are ordinarily located far from the source of acid supply. Installation of acid plants at the mines has not solved the difficulty. It takes approximately 1.5 lb. of sulphuric acid to dissolve 1 lb. of copper as sulphate. If hydrochloric acid is used, it takes approximately 0.6 lb. of acid to extract one pound of copper as cuprous chloride, and 1.1 lb. as cupric chloride. Much of the acid, whether sulphuric or hydrochloric, combines with the base elements of the ore and serves no useful purpose. The copper solution, as drawn from the ore, is usually acid; it is necessary, therefore, if iron is used as the precipitant, to neutralize the free acid before precipitating the copper. If this precaution is not taken the solution will neutralize itself at the expense of the iron. It is evident that the acid, which was provided at some expense, must again be neutralized at further expense without having extracted any copper.

All Acid Wasted Ordinarily

The amount of acid which it is necessary to provide, in any process, is considerably more than that combining with the copper, and all the acid is irrecoverably lost when iron is used as the precipitant. In some methods the ferric-sulphate solution is used after the copper has been precipitated by the iron, but it is too slow in solvent action to admit of wide application.

Theoretically, 88.8 lb. of iron are required to precipitate 100 lb. of copper from sulphate solutions. In practice it takes from 200 to 300 lb. of scrap iron. Here, again, a large expense is incurred in providing iron with which to precipitate the copper. In commercial centers, where scrap iron is cheap, this matter is serious enough, but in distant mining camps it is fatal to the cheap recovery of the copper. The copper precipitated by scrap iron is usually from 75 to 85 per cent. pure.

Difficulties of Electrolytic Processes

Electrolytic processes have their own peculiar difficulties. In all of them the electrolysis is confined to the precipitation of the copper and regeneration of the solvent. The solution of the copper from the ore is the same as for the regular chemical processes. Among the greatest difficulties so far encountered in electrolysis is in the use of insoluble anodes, and of diaphragms, if diaphragms are necessary.

It is evident that any wet process to be eminently successful, must fulfill the following conditions: (1) The process must extract the copper, silver and gold from the ore in one operation; (2) the solvent must be reasonably active and be cheaply produced; (3) the solvent must be cheaply regenerated; (4) the copper must be cheaply precipitated from acid solutions; (5) the precipitated copper must be reasonably pure.

Theory of the Greenawalt Process

In the electrolytic process herewith described[1], the copper is dissolved by dilute acid chloride solutions, and then precipitated by electrolysis, while at the same time the acid, which was combined with the copper, is recovered, being again regenerated as free acid, at the expense of sulphur dioxide and water. Salt is the only chemical which it is necessary to provide. Theoretically, the chlorine in the salt is not consumed, nevertheless in practice, about one-eighth pound of salt should be provided with every pound of copper produced. The oxide, carbonate, and silicate ores of copper may be treated without roasting. The sulphides are roasted. If the ore is roasted, salt may be added during the roasting.

The ore, after being crushed, is placed in large leaching vats for chemical treatment. The first step in the chemical process consists in combining chlorine generated from metal chlorides by electrolysis, with sulphur dioxide produced by roasting concentrates or sulphide ore, in the presence of water, to form acid. This may be shown by the following well known reactions:

$$2Cl + SO_2 + 2H_2O = 2HCl + H_2SO_4. \quad (1)$$

$$2HCl + CuO = CuCl_2 + H_2O. \quad (2)$$

$$H_2SO_4 + CuO = CuSO_4 + H_2O. \quad (3)$$

Both sulphuric acid and copper sulphate react with common salt to form hydrochloric acid or cupric chloride, so that neither the sulphuric acid nor the copper sulphate could exist in the solution. These well known reactions are:

$$H_2SO_4 + 2NaCl = 2HCl + Na_2SO_4. \quad (4)$$

$$CuSO_4 + 2NaCl = CuCl + Na_2SO_4. \quad (5)$$

Cupric chloride, when warm and in the presence of other metal chlorides, acts readily on silver and its compounds in the ore to form silver chloride, thus:

$$Ag + CuCl_2 = AgCl + CuCl. \quad (6)$$

From 80 to 90 per cent. of the silver may in this way be extracted with the copper, especially if the ore is given a chloridizing roast. If the ore contains considerable silver, it is desirable to leach with a fairly concentrated solution of base metal chlorides.

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[1]U. S. Pats. 968,651, 968,652 and 968,845.

The solubility of chlorine in water is limited. By the indirect method of combining the chlorine with sulphur dioxide and water to form acid, any desired strength of acid solution may be obtained for the copper, and a chlorine solution of sufficient strength for the gold.

Cuprous Solution Formed

The cupric chloride solution, issuing from the leaching vats, is saturated with sulphur dioxide obtained from roasting sulphide ore. This converts the cupric chloride into the currous chloride, thus:

$$2CuCl_2 + SO_2 + 2H_2O = 2CuCl + 2HCl + H_2SO_4. \quad (7)$$

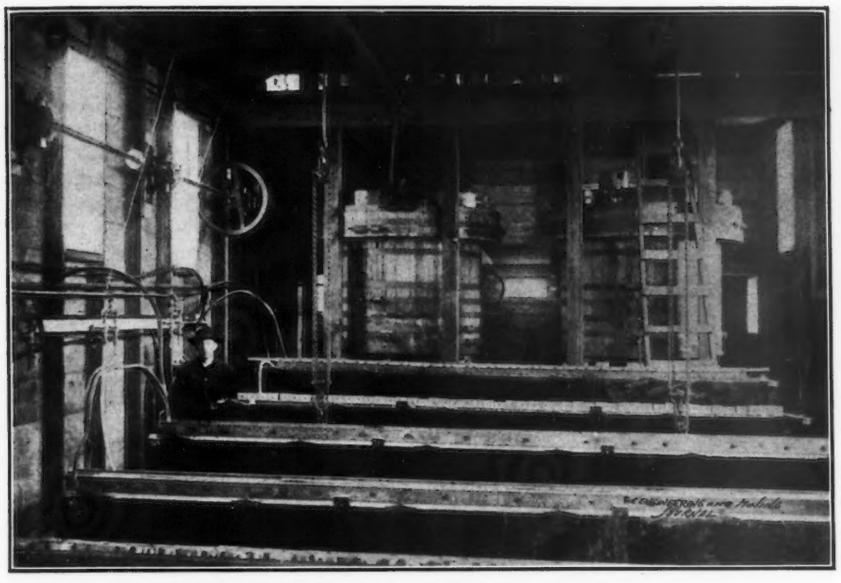
The object of this is: The electric current deposits twice as much copper, theoretically, per ampere, from a cuprous as from a cupric solution, and with an expenditure of only 65 per cent. of the energy per unit of copper; the sulphur dioxide, combining with cupric chloride and water, produces large quantities of acid. A molecule of acid is in this way regenerated for every molecule of copper reduced from the cupric to the cuprous condition. For every pound of copper reduced from the cupric to the cuprous chloride, 1.4 lb. of acid is regenerated; the excess of sulphur dioxide combines with the chlorine liberated during electrolysis of the cupric chloride to precipitate the copper, thereby again regenerating 1.4 lb. of acid for every pound of copper reduced from the cuprous chloride to metallic copper. The reactions are:

$$2CuCl + \text{electric current} = 2Cu + 2Cl. \quad (8)$$

$$2Cl + SO_2 + 2H_2O = 2HCl + H_2SO_4 + 75 \text{ calories}; \quad (9)$$

the above reactions give rise to an electromotive force working with the current, thereby greatly reducing the necessary voltage in the deposition of the copper; it dispenses with the necessity of diaphragms in the electrolytic precipitating cells; it is possible by this method, to extract other valuable metals from the ore, with the copper, and with the same solution.

This is not possible when working on a sulphate basis; insoluble anodes, precipitating from chloride solutions, are vastly more durable than when precipitating from sulphate solutions. Graphitized carbon electrodes have for many years been successfully used both in the United States and Europe for the electrolytic decomposition of the various metal chlorides, while the productions of a suitable insoluble anode for the decomposition of sulphates, may still be regarded as one of the unsolved problems of electro-chemistry.



Tank Room—Greenawalt Electrolytic Plant

Excess Acid Regenerated

It is evident, that in depositing one pound of copper, 2.8 lb. of acid is regenerated at the expense of sulphur dioxide and water. This amount of acid is capable of taking up twice the amount of copper from which it is precipitated. The regenerated acid solution is again applied to the ore, where some of the acid again combines with the copper, and some with the base elements, principally lime, forming the insoluble calcium sulphate, which remains in the ore. The sulphuric acid is the one which is eliminated by combining with the base elements, while the hydrochloric acid combines with the copper, again resulting in the formation of the original cupric chloride. This cycle of solution, precipitation, and regeneration, is repeated indefinitely. When one vat of ore is sufficiently treated, the solution is turned into the next.

All of the metal chlorides have the faculty of displacing copper from its sulphate combinations. For example, if there is lime in the ore, as there usually is, both the sulphuric and hydrochloric acids may combine with it. If the hydrochloric acid combines with the lime, the result will be the formation of calcium chloride, but the calcium chloride will at once react with the copper sulphate in the solution and convert it into the cupric chloride, thus:

$$2HCl + CaO = CaCl_2 + H_2O. \quad (10)$$

$$CuSO_4 + CaCl_2 = CuCl_2 + CaSO_4 \quad (11)$$

It is evident, therefore, that the sulphuric acid is the one which is eliminated by reacting with the base elements; and the sulphuric acid is renewed by the sulphur dioxide from the roasting furnace. The base-metal chlorides act as a solvent for the silver chloride.

If there is gold in the ore the acid chloride solution is charged with chlorine, generated either from the copper chloride or from common salt, by electrolysis. It takes 1.7 lb. of salt to produce 1 lb. of chlorine, and 5 lb. of chlorine will, ordinarily, extract the gold from a ton of the average copper ore. This chlorine is not lost, but is ultimately converted into base metal chloride, in which form it is again used to extract the copper and silver from new charges of ore. Theoretically, none of the chlorine used in the process, whether free or combined, is lost. It simply changes its condition from acid to chloride in the leaching vats, and is again regenerated to acid by the electrolysis. In practice there is, of course, a small unavoidable loss of chlorine, but this should not exceed that contained in one-eighth pound of salt per pound of copper produced.

Sulphuric Acid Consumption

It takes from one-fourth to one-half pound of sulphur, usually in the form of sulphide ore, or concentrates, to produce one pound of copper. This sulphur is used in the form of sulphur dioxide, produced from roasting the ore. After the ore is roasted, it is treated in leaching vats for the extraction of the copper. The sodium sulphate, produced in operating the process, is inert; its presence in the solution does not appear in any way to be advantageous, neither does it appear to be deleterious. It will be noticed that sulphur dioxide is the substance consumed in the sulphate processes, as it is also the substance consumed in the present chloride process; but the electrolytic deposition in the chloride process is from a chloride and not from a sulphate solution. In this way, one of the greatest difficulties in the electrolytic extraction of copper from its ores—that of the insoluble anode—is entirely overcome.

It is intended primarily to work the process with impure solutions. Any electrolytic method, depending on pure solutions for success, must, of necessity, be unsatisfactory. Nevertheless, in time, the solution may contain sufficient undesirable elements to make their removal advisable. The elements most injurious to copper, are bismuth, arsenic and antimony. These, together with all the metals of the first and second groups, may be completely removed from acid solutions by hydrogen sulphide, and at the same time regenerating an amount of acid equivalent to the metals precipitated.

Regeneration by Caustic Alkalis

Should a more thorough purification be desired, the following method is preferred: Salt (NaCl) is electrolyzed to produce chlorine and caustic soda, thus:

$$NaCl + H_2O + \text{electric current} = Cl + NaOH + H. \quad (12)$$

The chlorine thus obtained is converted into acid thus:

$$2Cl + SO_2 + 2H_2O + 2NaCl = 4HCl + Na_2SO_4. \quad (13)$$

which is used to dissolve more copper from the ore. The caustic soda is used to purify the solution by precipitating out the base elements, thus:

$$RCl_2 + 2NaOH = 2NaCl + R(OH)_2, \quad (14)$$

after which the purified solution, regenerated in salt, is filtered from the precipitated hydroxides.

Two kilowatt-hours, costing from one-half to four cents, will produce approximately one pound of chlorine, capable of dissolving two pounds of copper, and 1.2 lb. of caustic soda which, at the same time, is used for the purification of the solution and regeneration of the salt. From this it will be seen that the cost of the purification of the solution is a negligible matter.

Iron cannot well accumulate in the solution in the operation of the process. Ferrous chloride is a good solvent of copper, but in dissolving the copper the iron is precipitated as the insoluble ferric oxide, and is in this way continually eliminated from the solution, thus:

$$2FeCl_2 + 3CuO = Fe_2O_3 + CuCl_2 + 2CuCl. \quad (15)$$

$$2FeCl_2 + 3CuCO_3 = Fe_2O_3 + CuCl_2 + 2\,CuCl + 3\,CO_2. \quad (16)$$

It will be seen from this that the iron is not only eliminated, but that the chlorine, combined with the iron, renders its equivalent in copper.

In this respect the chloride solution has an advantage over a sulphate solution, since in a chloride solution the iron is continually eliminated as the ferric oxide, while in a sulphate solution it simply changes from the ferric to the ferrous condition, but it is not eliminated.

The iron in the chloride solution as it is applied to the ore will be in the condition of ferric chloride, and the ferric chloride is not only a good solvent of copper, but is also an excellent chloridizer of the silver which may be contained in the ore.

Application of the Process

The process, in practice, is carried out very much the same way as any other wet method of treating ores. With the exception of the electrolysis, it is not essentially different, either in installation or operation, than the cyanide or chlorination processes for the extraction of gold, the hyposulphite process for the extraction of silver, or the acid processes for the extraction of copper from leachable ores. In this electrolytic copper process, however, the power, both in operation and installation, is an important factor. The power accomplishes both the precipitation of the copper and the regeneration of the solvent. While the aggregate cost of the power is an important factor in the cost of operation, it is quite small in any case per pound of copper extracted.

In the location and installation of plants, cheap power, preferably water power, is desirable. Fortunately, if the conditions at the mine are adverse to the cheap development of power, it may be generated from coal at the nearest railroad point and transmitted electrically where desired. Frequently, however, water power may be available within a radius of 50 miles from the reduction plant, and such a distance is not too far for economic transmission.

In this respect the electrolytic process has a marked advantage over ordinary chemical methods, and over smelting where the fuel and fluxes for suitable ore mixtures have to be transported to the smeltery.

Since, therefore, power, which is the essence of the electrolytic process, can be cheaply transmitted no matter what the physical condition of the country may be, the cost of reducing the ore is not so much dependent upon the location of the mine or its proximity to lines of transportation.

Silicious Ores Best for the Process

The ores best adapted to the electrolytic treatment are those which are highly silicious, preferably oxidized, and containing but little lime. Such ores are most difficult to smelt, since they contain little or no fluxing material, and usually not sufficient sulphur to form a desirable matte. The ores suited to the process may be classified as follows: Silicious oxidized copper ores, containing the copper either as oxide or carbonate; silicious sulphide ores; silicious copper ores containing silver, gold or lead; silicious silver and gold ores containing copper; copper concentrates, which may contain either silver, gold or lead. The iron in the concentrates does not offer any serious difficulty. If there is lime in the ore, it will not be present in the concentrates in injurious amounts. Zinc is harmful but not serious in small quantities.

Up to the present no satisfactory chemical process has yet been disclosed for the treatment of silicious gold and silver ores containing copper. It is claimed for this process that it solves the problem of the treatment of these ores. Not only is the gold and silver recovered satisfactorily, but the copper in the ore is a benefit to the treatment, and is recovered at a profit.

Impurities in Ores and Their Effects

The elements most injurious to the electrolytic process, and which are frequently found in copper ores, are calcium, magnesium, aluminum and zinc. Any other elements offer no serious obstacles to the process. Of the injurious elements, the quantities which are fatal depend largely on the way they are combined in the ore. For example, calcium occurring as the sulphate, gypsum, is unaffected by the process, but calcium occurring as the oxide or carbonate, lime or limestone, is likely to give trouble if present in considerable quantities. If the ore contains much iron, roasting is desirable; if it contains sulphides, roasting is necessary.

Plants may be erected of any size and operated in any unit. For economic reasons, however, it will not ordinarily be desirable to erect and operate plants of less than 25 tons per day. For large plants a unit of 250 tons, or even 500 tons per day, will probably be the most convenient. The power consumed in electrolysis is proportional to the amount of copper deposited.

The fineness to which it is desirable to crush the ore will depend largely on the nature of the ore. Some carbonates may be most economically treated by crushing no finer than four to eight mesh, while with sulphides it is advisable to crush to 12 or 16 mesh. If agitation is resorted to in the chemical treatment instead of percolation,the ore may be crushed to any degree of fineness desired, as is now done in many plants treating gold ores by the cyanide process. The sulphur used in the process may be obtained from any source, and may be either in the form of sulphur or of sulphide ore. Ordinarily the sulphur dioxide will be obtained from roasting sulphide ore, in which the roasting is preparatory to further metallurgical treatment.

Copper Produced 99 per Cent. Pure

The copper is deposited by the electric current in a granular condition, and does not adhere to the cathodes. It is of exceptional purity. If carefully washed

to free it from soluble salts, it will assay 99 per cent. purity before melting and casting into ingots. It is not intended by this process to make electrolytic copper direct from the ore, nevertheless, if the ore is not too complex, it is reasonably certain that copper can be produced which, after melting and fusion refining before casting into ingots, will equal in grade either Lake or electrolytic copper. A good grade of casting copper can be produced from any ore.

The copper as deposited in the electrolyzer, is accumulated from time to time, washed, and charged into an ordinary reverberatory melting furnace and cast into ingots, or into anodes, if the copper contains sufficient silver and gold to warrant electrolytic refining. During the operation of melting it can also be refined. The copper may be withdrawn from the electrolyzers in about 10 minutes. Ultimately, electrolyzers will be built so that the copper may be withdrawn while they are in operation, so that it will not be necessary to put them out of commission except for repairs. The gold and silver occurring in the ore may be deposited with the copper, or separately, if desired. If the copper needs electrolytic refining, there would be no advantage in depositing the metals separately.

Recovery 90 per Cent. or Over

The percentage of extraction that may be expected will depend much on the nature of the ore. On several tons of Arizona carbonate ore, assaying 13 per cent. copper and 5.3 oz. of silver per ton, the tailings assayed 0.25 per cent. copper and 0.4 oz. silver per ton, showing an extraction of 98 per cent. of the copper and 85 per cent. of the silver. On a somewhat similar ore from Utah, there was no difficulty in getting an extraction of 99 per cent. of the copper. The ore is these tests was treated raw, crushed to 4 mesh. On some pyritic concentrates from New Mexico, assaying 10.2 per cent. copper, an extraction of 90.5 per cent. was obtained in a test treating two tons of the material, crushed to 12 mesh, and roasted. A silicious sulphide ore from the San Juan district in Colorado, assaying 6.8 per cent. copper and some silver and gold, showed an extraction of 94.5 per cent. of all the metals, with the ore crushed to 16 mesh and carefully roasted.

Present Experimental Plant Described

The testing and experimental plant in Denver is capable of treating from eight to ten tons of ore at a time, in two vats holding five tons each. A 25-h.p. boiler and a 20-h.p. engine furnish the power to drive a low-voltage dynamo of 500 amp. Two electrolyzers, each having a capacity of 500 amp., are used to precipitate the copper. These electrolyzers are test machines, which are soon to be replaced with two larger ones of 1500 amp. each. After an efficiency test the precipitated copper is carefully collected, washed to free it from soluble salts, dried and weighed to ascertain both the current and energy efficiency. A furnace of three tons capacity is used to roast sulphide ores preparatory to the chemical treatment.

Efficiency of Test Plant

From such tests, covering a wide range of conditions the basis of power consumption in the electrodeposition was obtained. One of the principal factors in these conditions was the current density, which was varied from 6.2 to 66 amp. per sq.ft. The average of these tests, taking good, bad and indifferent, ranging over a period of several years, shows that a pound of copper was deposited per kilowatt-hour, and this is made the present basis of costs and power. The best tests show over 100 per cent. better than this; some as much as 2.6 lb. per kilowatt-hour. It is reasonable to suppose that with experience and further investigation as to the cause of the principal loss of efficiency, there should be no difficulty in bringing the average up to the best yet recorded, or 2.6 lb. per kilowatt-hour. It is safer, however, to take the average efficiency for the present, until the higher efficiency is permanently maintained. Even the higher efficiency is only about 50 per cent. of the theoretical efficiency, so there is an extremely wide margin for improvement in the saving of power from the basis of 1 lb. of copper per kilowatt-hour.

During all the tests at the Denver testing plant, the same solution was used; it was never purified, nor has any acid been added since the first test, over two years ago. The tests were made intermittently during that period. The Acheson graphitized electrodes used during these tests have never been replaced and, in fact, do not show any perceptible wear. Comparative tests were made with and without diaphragms, with the result that the diaphragms have been permanently discarded.

Cost of Treatment

The cost of power varies greatly in the various copper-mining districts of the world. In large installations, under ordinarily favorable conditions, there is no reason why power should not be produced for $50 per kilowatt-year, either with hydroelectric, gas, and possibly steam installation, assuming that for gas and steam the power plant is located at the railroad and the power transmitted to the reduction works. In one of the large typical hydroelectric installations in Colorado, the power costs approximately $25 per kilowatt-year, with an installation of several thousand kilowatts.

On a cost basis of $50 per killowatt-year for the power, the cost per pound for electrodeposition, on a basis of 1 lb. of copper per kilowatt-hour, would be 0.58c., and for $25 per kilowatt-year it would be 0.289c. It is reasonably certain, however, that even these costs can be cut in half with further information on the process as to the best working conditions. In this connection it must be remembered that the power consumed also regenerates the acid, so that the cost of 0.58c. is comparable to the combined cost of acid and iron consumed in the ordinary sulphuric-acid process.

Regulation of Acidity

The electrolyzers used are entirely automatic. No diaphragms are employed, and the cells require no further care than to remove the granular copper at stated intervals, which may vary from a day to a week, or even more. The acidity of the solution is also easily regulated. The amount of acid regenerated is at least twice that combined with the copper. Presumably the acid consumed by the matrix of the ore is a constant factor. That is to say, all ore containing 1 per cent. copper will consume about the same amount of acid due to foreign substances, such as lime, as ore from the same mine having 10 per cent. copper. A 10 per cent. ore, containing 200 lb. of copper, will regenerate 560 lb. of acid, while a 1 per cent. ore, containing only 20 lb. of copper, will regenerate only 56 lb. of acid. It is, therefore, easy to regulate the acidity of the solution by regulating the quality of the ore, and without resorting to extraneous material.

It was clearly established in the tests in electrodeposition that the efficiency drops quite rapidly as the solution becomes impoverished in copper, and if it is too highly acid. In some of the tests the solution showed less than 1 per cent. copper, and it was in these tests that the lowest efficiencies were obtained.

In determining the energy efficiency for any commercial plant, much will depend on local conditions, especially as to the cost of power. If the power is cheap, it would be wise to drive the electrolyzers at a high current density, whereas, if the power is limited or expensive, better average results will be obtained at the lower current densities.

In the description here given, zinc has been considered as an injurious element. It is evident that the possibilities exist in the process of turning the zinc into profitable account, but as no exhaustive work has been done along this line of the process, nothing is at present claimed for it.

Cost of Plant

The approximate cost of installation and operation, of extracting copper by this method, from data obtained at the Denver testing and experimental plant, is summarized below. The figures are based on a treatment of 100 tons of 5

per cent. ore per day; $50 power cost per kilowatt-year, and 1 lb. copper deposited per kilowatt-hour.

APPROXIMATE COST OF PLANT.

Power installation	$ 50,000
Motor-Generator set; 5000 amp., 110 volts	10,000
Electrolytic department, electrolyzers, cables, etc.	25,000
Leaching department, eight 100-ton vats, pumps, etc.	10,000
Crushing department, crushing to 6 or 8 mesh	15,000
Miscellaneous	10,000
	$120,000

If the ore is a sulphide and has to be roasted, $30,000 should be added to the cost of installation, and 75c. per ton to the cost of treatment, making a total cost per ton of ore treated, of $2.71, and per pound of copper extracted, 2.71c.

COST OF TREATMENT.

	Per Ton of Ore.
Crushing, 8 mesh	$0.20
Leaching	0.15
Electro-deposition and regeneration, not including power	0.25
Power, electro-deposition, 420 k. w.	0.58
Repairs, renewals, etc.	0.10
Melting and casting into ingots	0.05
Superintendence	0.10
Interest on investment, 120,000 at 6 per cent	0.20
Amortization, $120,000 at 10 per cent.	0.33
Total cost, per ton of ore	$1.96
Total cost, per pound of copper extracted	1.96c.

These costs include the extraction of the silver and gold, if contained in the ore, and also small quantities of lead. It does not include general expenses of administration away from the reduction works, since such expense may be anything that the officers of the company choose to make it. The copper produced may be sold to the nearest consumers, without the necessity of passing it through an eastern selling agency, or eastern refineries.

Carbon Monoxide Poisoning from Explosion Products

The various explosives shown in the accompanying table were tested in an explosion bomb, and analyses made of the gaseous products. Analytical results as well as physiological experiments show that carbon-monoxide poisoning can be caused by any of these explosives.

OXIDES OF CARBON PRODUCED BY EXPLOSIVES.

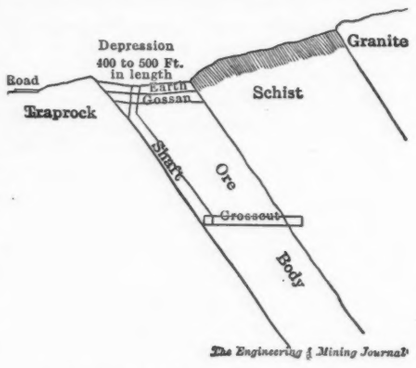
Explosive.	CO per cent.	CO_2 per cent.
Nitrocellulose powder	46.87	16.8
Gelatin dynamite	34.00	32.68
Carbonite	36.0	19.2
Picric acid	61.05	13.46
Trinitrotoluene	57.01	1.93
Ammonal	23.74	6.09

It is also pointed out by the experimenters, Lewin and Poppenberg (*Journ. Soci. Chem. Ind.*, Feb. 15, 1910), that in case of blown-out shots there may be oxides of nitrogen present, while in the gases from picric acid, trinitrotoluene and carbonite, small quantities of hydrocyanic acid were detected.

The McDonald Copper Mine, Quebec

The McDonald Mine, owned by the East Canada Smelting Company, Ltd., a subsidiary of the Precious Metals Corporation, of 49 Wall street, New York, is in the township of Weedon in the Province of Quebec, about 4½ miles northeasterly from Weedon station.

The eastern portion of the property comprising most of its area is granite. To the west of the granite is a broad band of schist the western limit of which seems to be just west of the range road, where outcrops of trap rock (still showing a schistose structure) are found. All of this band of schist contains pyrites. Near the western property line and about 500 ft. west of the contact between granite and schist, is a marked depression, showing on surface as a section of a lense, about 500 ft. in length and about 40 ft. wide at the middle. At about the middle of this lense and to the west of its long axis the McDonald shaft has been sunk, passing through earth and gossan into solid copper-bearing pyrites, the copper occurring as primary chalcopyrite mixed with pyrites and in a streak of high-grade chalcopyrite, and also a secondary bornite mixed with the pyrites. Southward on the same general strike there is a second depression less marked and wider, terminating in swampy ground. At the northern end of this swamp several pits have been dug through what appears to be gossan. No pyrites has yet been found here and the pits have in every case reached only schist. The sketch herewith shows the geological conditions and the orebody.



SECTION OF MCDONALD OREBODY, WEEDON, QUE.

SULPHIDE OREBODY 45 FT. WIDE

The first work on the McDonald mine was started about a year ago, at which time there was no equipment and the only work was a 20-ft. prospect shaft which was continued following the dip to 100 ft. where the orebody was crosscut and the vein was found to be 45 ft. wide. A drift was then driven to the north on the same level, 300 ft., the face of this drift now showing 20 ft. of solid ore. The vein was crosscut at 100 ft. north of the shaft, 43 ft. showing the vein at that point to be a little more than 42 ft. in width. A crosscut was started at 180 ft. north of the shaft or 80 ft. north of crosscut No. 2, and run in 9 ft. Other crosscuts have been proving additional ore.

SHIPMENTS BEGUN IN AUGUST

From the ore taken out during the development and from the stopes shipments were begun in August, 1910, to the Nichols Chemical Company, at Capelton, Quebec, where it was burned for the sulphur and the cinder shipped to the Nichols Copper Company, Laurel Hill, N. Y. The shipment of 1000 tons in August gave results of 5.82½ per cent. copper and 41.76 sulphur, while the shipment of a second 1000 tons recently completed shows an average of better than 5.85 per cent. copper and 43 per cent. sulphur. The company intends increasing its capacity.

Uses of Manganese

Minerals containing manganese are widespread, but few are available for use as ores, for most of them contain only small percentages of the metal. The oxides psilomelane and pyrolusite are the principal ores.

Pyrolusite, which contains about 60 per cent. of manganese, was used by the ancient Egyptians in decoloring glass—that is, in making it clear or transparent—for the addition of this mineral to glass sand neutralizes or in some way counteracts the effect of iron, which gives to glass green or other undesired colors. Pyrolusite, according to a press bulletin of the U. S. Geological Survey, is still used for this purpose, but ores or alloys of manganese are now more largely used in making alloys with iron, steel, copper, aluminum, and other metals, in making chlorine, bromine, and oxygen, and as a disinfectant, as well as in galvanic batteries and in bleaching, dyeing and painting. Spiegeleisen, so called from its brilliantly glittering surface, and ferromanganese, both alloys of iron and manganese, are prepared chiefly for use in metallurgy, especially in steel making.

The Wallkill siphon tunnel of the Castkill aqueduct, a part of the new water supply system for Greater New York, was driven 523 ft. in September, 1910, the bore being a full 17 ft. in diameter.

The Use of Coal Cutting Machinery

The Advantages and Disadvantages of the Adoption of Undercutting Machines in Mines. Also Notes on the Operation of Conveyers

BY R. H. ROWLAND*

The production of coal is one of the most important industries of the age, and has made possible the wonderful development of the nineteenth century. In point of value it exceeds the total production of all other minerals, and such an industry, which has overshadowed all others, is one to which the best thought must be given and the biggest skill applied; as a result, our leading mining engineers of today are constantly adopting new features or devices to economize the working of collieries, while paying due regard to safety. There are some seams of coal so thin that to work them to advantage and profit greatly taxes the brains of the management and the working of which sometimes ends in failure.

The use of machines for mining bituminous coal in the United States has more than kept pace with the remarkable growth of the industry itself. Modifications and improvements were made from year to year as demand for machines increased, and new conditions in mining developed.

Large Increase in Number of Mining Machines Used

The statistics of the United States Geological Survey emphasize in a striking manner that a new era in the history of coal mining is here, the number of mining machines in operation being 545 in the year 1891 in this country, while in the year of 1904 this number had increased to 7797, and the quantity of machines employed at the present time is considerably in excess of this figure. The proportion of the whole tonnage mined which is strictly machine coal, incerased from 6.66 per cent. in 1891 to 29.27 per cent. in 1904. Also while the production of coal increased, the proportion of machine-mined coal continued to gain still faster. It is, therefore, apparent that under certain conditions, the adoption of coal-cutting machinery is advantageous, as the American does not keep a machine at work that is not earning money, nor after another machine has appeared that will earn more.

There are many conditions, however, to be considered governing coal-cutting machinery before adopting it, and there are also examples in my own experience where, after numerous experiments and exhaustive tests have been made by different experts, mining coal by machinery has proved a failure, and it is my intention to show under what conditions coal-cutting machines can be successfully adopted, and where they should be avoided.

Mining Machines Not So Generally Employed in Europe

Coal-cutting machines have been employed to a much larger extent in this country than in foreign countries, which can be accounted for in the fact that, comparatively speaking, this is a new

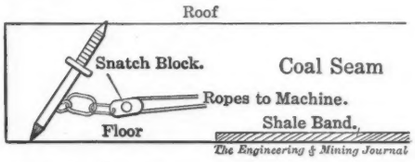


Fig. 1. Screw Jack Used as Anchor for Rope

mining country, and it has not yet been found necessary to develop thin seams, which present any difficulty or increased cost in getting. If we seriously consider, however, the increase in production of coal in this country, from 93 million tons in 1891 to 450 million tons in 1909, it is obvious that the time is coming when it will become necessary to work thinner seams at greater depths in order to maintain our output.

The principal reasons given by the advocates of coal cutters, for mining by machinery instead of by hand, are many, and are often complicated by local conditions. In general, they include the following: The actual cost of mining is lower; the industry is attended with less danger, and working conditions are improved; the quality of the product is superior; the mine may be more readily developed, and the production thus increased; and finally, the application of power to other purposes in the mine, pumps, ventilation, rock drills, etc.

With regard to the attitude of labor and its organizations toward machine mining, it is claimed that while mining by machinery reduces the cost of production and increases the output, it is not that the operator wishes to reduce the number of men employed, but to make the work of each man employed more effective by the aid of labor-saving machinery. It is also claimed from the workmens' point of view that instead of reducing wages it materially increases them, that instead of making the work harder it eliminates the most laborious and dangerous part, and finally that the mining machine does not prove itself a supplanter of labor, inasmuch as there is a dearth instead of a surplus of miners in the country.

Mining Machines Produce More Tonnage from a Smaller Area

It is contended by many authorities that mining machines will produce a given tonnage from a smaller mine area, than when pick work is in vogue, that the rooms and narrow places are cut more quickly, shot more easily, and loaded out more rapidly, in order to provide fresh working places for the machines. Therefore, a small number of rooms will maintain a given output, and the expense for ventilation, drainage and support of roof will be proportionately decreased. In my opinion, however, coal cutting is economical only when properly attended to, and when the conditions of the mine are favorable. The machine which is employed for holing should do the work of a large number of men, and it should do it in less time and at less cost, and with the production of less small coal. Where the production of small coal is of no account, as, for instance, where all the coal is used for coking purposes, the coal-cutting machine is robbed of one of its advantages over the working collier.

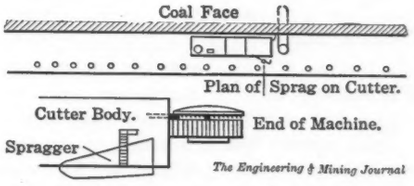


Fig. 2. Showing Sprag Fastened on Cutter

Another grave difficulty has been the nature of the roof and floor of the mine, over which the machine has to work. It is difficult to run a machine when the roof is coming down, and burying it at frequent intervals, and the time occupied in clearing the machine and giving it a fresh start, swallows all the profit that would accrue from the machine. The matter of roof can, in a good many instances, be overcome by careful and systematic timbering, but where the roof is of a very friable nature, it presents a difficult mechanical problem to support it until the machine has passed, and the coal filled out, and has also proved in many instances to be a costly one. Another consideration which has and will interfere with the use of coal-cutting

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machinery in certain districts, is the great prevalence of faults, rolls and interruptions; and in order to overcome this the machines employed must be portable.

One Test That Failed

One test in my experience of an attempt to make coal cutting a success, was carried out in a coal seam worked on the longwall method; and although it proved a failure, the failure could not be attributed in any way to the fault of the machine, the whole difficulty being in the softness of the coal, and the inability to get a sufficient number of feet cut per shift. The object primarily was to ascertain as far as possible whether coal cutting could be made profitable in a seam where the coal was unusually soft.

It was calculated that for the cutter to prove itself a success it would have to cut 180 to 250 ft. per shift on an average, and a 360-ft. cut would be equal to 30 men's work. The seam varied in hight from 18 in. to 36 in. of clean coal, except for a small band of shale near the floor. The coal was so soft that it required no shooting when the cutter traveled along the face.

The machine was cutting in a line with the cleat of the coal; in other words, the face was advancing in a bordways direction. The roof consisted of hard post rock, and in this respect could not be more favorable for coal cutting, as it is hard, level, and does not require a lot of timber at the face. The floor consisted of seggar clay, which afforded an excellent bottom for the machine to slide upon, inasmuch as it was not designed to run on rails, which latter fact proved itself an advantage. A deal of time was wasted by coal falling on the machine and blocking it with small coal. After a few days' trial, however, the machine seemed to cut out the fallen coal very well and with comparative ease, and a small current was consumed in comparison with the work performed. Two men only were required to operate it, and one man was also required to shovel the kirvings into the gob and set timber behind the machine, in order to make room for the fillers of coal, and to insure clean coal. The cable for use on the face was rolled on and off a drum kept in a convenient place near the switchbox.

A Satisfactory Method of Cutting

In this method of cutting, screw jacks were found to be necessary in order to keep the machine up to its work; they were easily set and taken down. The anchor for the rope was also a large screw jack, and was set in the roof, as shown in Fig. 1. On the jack it will be seen that a snatch block is fastened. The rope from the cutter drum goes around this block and returns to the back end of the machine, near to the coal face and the cutting arm. When the machine was made ready it was started, and after cutting for three or four ft., began to climb out. Eventually, after many attempts, the machine was got back to its work, and still great difficulty was experienced. A sprag or plough was then suggested and fastened on to the rear end of the machine and this kept the latter up to its work well, in comparison. The sprag was fastened on the cutter, as shown in Fig. 2.

After some weeks at cutting in this manner, it was found that there was something more than the mere cutting of the machine, which forced it from the face. It was then considered that some sort of fender placed upon the front end of the machine, near to the coal face, would help matters, and when this was done, things worked much better. The angle at which the rope was led along the face was altered, and this made an improvement. About 60 to 90 ft. per shift, however, was all that could be gotten out of the machine, and on account of the coal falling and clogging the arm, coal cutting was stopped. The same machine was then tried in the same seam at another colliery not far distant with no better results.

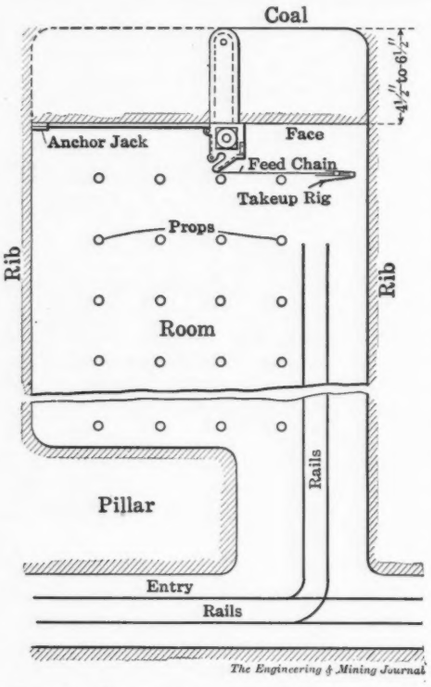

FIG. 3. ROOM-AND-PILLAR MINING WITH CHAIN MACHINE

The result of these few weeks of experiment with the machine proved that it was altogether unsuited to the particular seam, and that what could be done was not sufficiently satisfactory to enable the cost of getting to be lowered by machine cutting. The chief reason may be taken to be the nature of the coal. There was, however, one disadvantage to the machine on the face, and that was that the face was advancing in a bordways direction, and consequently the coal fell more easily on the machine than it would if the face had been advancing in a headways direction.

Working on the Longwall Plan

Now let us consider the conditions of a mine operated on the longwall system of working, favorable for coal cutting. In my opinion, the seam should not be thicker than five or six feet, while it may be as thin as 18 in. For example, we will take a seam 4 ft. in thickness, having 9 in. of dirt under it suitable for holing in, and assume a good shale roof. It first becomes necessary to prepare the coal face for the machine; that is, get the face in a long straight line, with gateways up to it at intervals of 90 ft., so that the coal can be readily gotten out, each gate having 45 ft. on each side to get out, and being worked by four men, two colliers and two loaders. The length of the coal face should not be less than 350 to 400 ft., as this can be cut in one night, and the gateways are set out so that the men can draw the coal out on the following day. There is one important thing to be attended to in this long, straight face, and that is the packing or stowing of the mine. If this is neglected there is a liability of getting a fall of roof on the face, stopping the machine from cutting, and consequently causing a deficiency in the output. If, however, this matter is attended to in a proper manner, and also all the back timber drawn out, with the exception of the necessary rows of props for insuring the safety of the men, and complying with the mining laws, good results can be obtained by coal cutting with machines.

Machines Economical in Thin Seams

Regarding the use of machines in thin seams, it is not to much to say that many seams of 18 in. and up to 30 in. are able to be worked profitably only because of the existence of the coal-cutting machine. There is a record in my experience where 75c. per ton was saved in cutting, and 50c. per ton increased value obtained on the product. There is another instance where an 18-in. seam was being cut with a bar machine which would have been impossible with hand holing.

There is a longwall machine in use, virtually a chain breast machine, with the chain that carries the cutting tools arranged to run at right angles to the frame of the machine instead of parallel as in the chain breast machine. The mines in which these machines are at work have also adopted the room-and-pillar method to the machine. It is room-and-pillar working, but the rooms are made 60 ft. wide and the pillars between the rooms vary from 20 to 30 ft., and the machines run across the face, to and fro.

Fig. 3 shows room-and-pillar mining with a chain machine, which feeds it-

self across the face as shown, and is a decided improvement over the old type of breast machines, which required from 5 to 10 min. to cut, back out the machine, move and set jacks ready for the next cut, making the progress across the face average from 4 to 8 in. per minute.

Determining between the Chain and the Pick Machine

The various classes of coal cutters are operated either by electricity or compressed air, and while machines of almost every conceivable type have been manufactured, the two most commonly used are the chain machine and the pick machine. In selecting a machine to operate successfully it is of the greatest importance that the conditions under which it has to work should be carefully considered.

The makers and advocates of the electric machine claim that its superiority over the compressed-air machine consists in the following: That it cuts more rapidly; makes less slack; is easier on the runner, and that the cutting is cheaper. Many engineers advocate the use of electricity as the motive power, owing to the fact that it is the most economical motive power for long distances. The selection of a coal cutter, however, is somewhat dependent upon the plant already existing at the particular mine, inasmuch as it is desirable to apply that power for other purposes, such as pumps, ventilation, rock drills, etc. While this is a consideration in mines fully developed, it will also have a peculiar interest in the opening out of new mines, especially having regard to the centralization of the power transmission for a group of mines.

It is not my intention, however, to embrace the respective advantages and disadvantages of the use of air and electricity; suffice it to say that compressed air, like electricity, has seen the time when, not being understood, it has been applied wastefully, and that correctly used, it is inherently economical, being practically a perfect gas. Important developments are continually being made, and the future promises much in the advancement of compressed-air appliances.

Conveyers in Coal Mines

The use of conveyers in coal mines appears to be of great advantage generally, for when the seam is suitable, the cost is considerably reduced, a large amount of stonework is done away with, the coal is made a little softer by extra weight under certain conditions, less timber is required, first cost is comparatively small, together with low cost of upkeep, small outlay and easy manipulation, and finally their simplicity.

Fig. 4 shows relative positions of two faces opened out, each 150 ft. in length, the one face advancing in front of the other, where a separate conveyer was employed for each 150 ft. The two faces are advancing in a westerly direction, the right-hand face being the north face shown in the illustration. The canch in this seam which is taken up from the bottom is about 4 ft. thick, the seam of coal being about 3 ft. in thickness. The conveyer face between packs was supported by soft-wood chocks at intervals of 8 ft. all down the face, and in a line near the conveyer rails. The faces seemed to stand well, the roof bending well into the gob as the chocks were drawn.

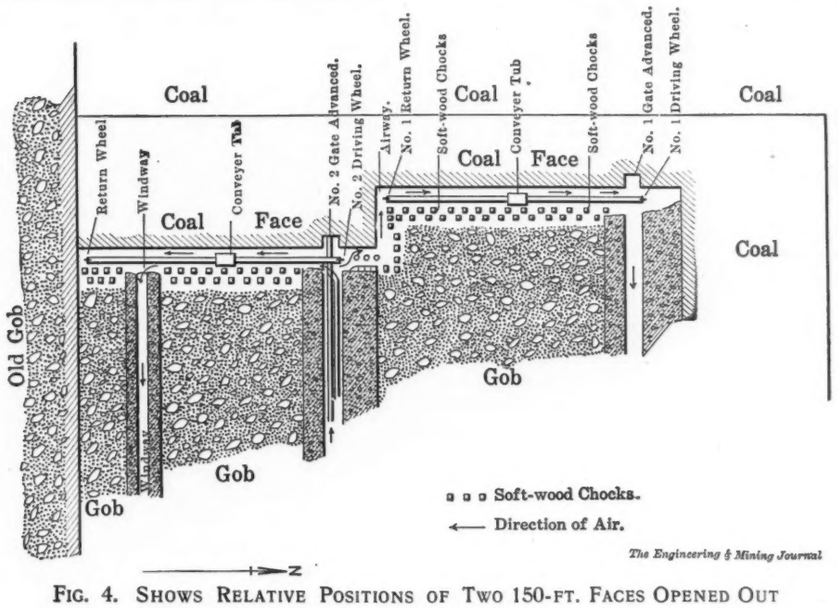

FIG. 4. SHOWS RELATIVE POSITIONS OF TWO 150-FT. FACES OPENED OUT

The packs were from 18 to 24 ft. in width. The rate of travel forward was about 3 ft. 9 in. per day. The operation of moving up the conveyers and timbering the face occupied about three hours, and required three men to manage the whole of it. The coal is all hewn and filled by hand, no coal cutters or any other machinery, except the conveyer, being in use. Ten hewers per shift on the 300 ft. of face were employed, or 20 hewers per day for a period of 5¼ hours each on the entire face. Over 900 tons of coal were produced on the 300-ft. face for two weeks by this means, which I think may be considered as exceptionally good work, inasmuch as the seam is of a comparatively hard nature. The difference of these two faces is marked, inasmuch as their coal-producing qualities are different, the back face producing more coal on account of the extra weight of the strata, and also on account of having two loose ends.

Another Arrangement for a Conveyer

At another colliery where mechanical coal conveying was adopted, the conveyer was placed at the left-hand face, and the coal delivered to the main gateway, which was kept some yards in advance of the face for the purpose of obtaining siding room. This main gate was made 6 ft. in clear hight, by taking up about 3 ft. of bottom canch (the seam being about 3 ft. in thickness), and was driven wide enough for two roads, one for full and the other for empty cars. On the right-hand side, the coal was left solid, the idea being to bring it back by means of the same gateway, with the conveyer, after the face had gone up a certain distance. This face was about 275 ft. in length, and on the far side a gateway was kept up as an air road, and for a second traveling way. The timber was sent along this gateway and put on the conveyer, so that it could be taken off at any desired part of the face, and this saved the necessity of dragging it along by hand. The coal is soft, and in this case also was gotten by hand hewing.

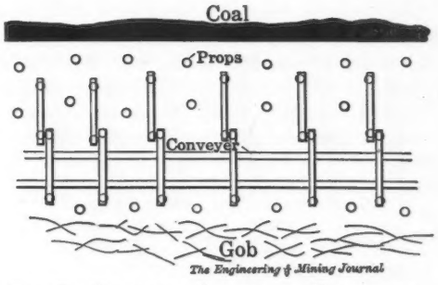

FIG. 5. ORIGINAL SYSTEM OF TIMBERING

The conveyer was moved up as often as required, generally every night, but this, of course, was dependent on the advance of the face during the shift. It was undesirable that the face be allowed to get more than about 7 ft. away from the conveyer, as in that case casting becomes more difficult.

The original system of timbering was to have two rows of props and planks at right angles to the face; the plank ends overlapped in the middle for a few inches, as shown in Fig. 5.

When moving the conveyer up after the day's work the middle props had to be knocked out to enable the conveyer to come up to its new position. The roof consisted of a strong sandstone, and under ordinary conditions is an ideal one, but knocking this timber out on such a long face caused the roof to "weight" and bend down toward the gob, the consequence being that one day part of the the face was almost completely closed, the roof bending down on the troughs and holding them tight for a distance of over 100 ft. This necessitated a deal of work to release the conveyer, and the hewers had to skirt along the fallen part in the coal, with a headway lift, and a new face was by this means opened out. After this experience it was decided to adopt a different direction of face and method of timbering. The new face was set away at about 10 deg. to the cleavage, and was reduced to about 150 ft. in length, which was afterward gradually increased to 250 ft. Hard-wood chocks were set next to the gob at a distance of 6 ft. apart, and the planks dispensed with, only props and lids being used, no trouble afterward being experienced with the roof.

Inasmuch as conveyers have been used to advantage in the cases above cited, it would appear to me that if adopted in conjunction with reliable coal cutters, they should be a great improvement on the old method.

Coal Mining Statistics of Great Britain

SPECIAL CORRESPONDENCE

The coal-mining statistics for Great Britain during the last 10 years indicate almost continuous increases in the number of persons employed and the total amount of mineral raised. Upon these two counts the situation may be regarded as healthy, but the death rates and individual efficiency of the colliery workers are less convincing. The tendency seems to be for the death rate—whether viewed in proportion to the number of persons employed at the mines or the amount of coal raised per fatality—to become heavier, while on the other hand the production of the miner is declining.

An Increase in the Death Rate

Comparing the figures for last year with those for 1900 and making the necessary calculations on the percentage basis, the following points may be established:

(1) There has been an increase of 233,946 in the number of persons employed, equivalent to 29.9 per cent. increase.

(2) There were 38,588,399 tons more coal raised, equivalent to 17.1 per cent. increase.

(3) There were 441 more deaths, working out 43.5 per cent. increase.

(4) The death rate increase per thousand persons engaged approximates 11.8 per cent.

(5) The death rate per million tons of coal raised is equal to an increase of 22.7 per cent.

(6) The output per individual worker has been lowered by 28.5 tons, representing a percentage decline of 9.9.

(7) For each fatality 40,973 fewer tons of coal were raised, working out to a decline of 18.5 per cent.

Capacity of Individual Miner Reduced

In this way the labor and product at British coal mines may be estimated in relation to the fatalities, and in the result the authorities cannot find much material for gratification. Undoubtedly a record was established last year in employment being found for 1,013,998 workers, this being the first occasion upon which the million mark has been exceeded, but though 73,380 more persons were engaged than in 1907, the coal product was less by 4,050,290 tons,

TABLE SHOWING LABOR AND PRODUCTION.

Year.	Persons Employed.	Coal Production in Tons.	Output per Person in Tons.
1900	780,052	225,170,163	288.6
1901	806,735	219,037,240	271.5
1902	824,791	227,084,871	275.3
1903	842,066	230,324,295	273.5
1904	947,553	232,411,784	274.2
1905	858,373	236,111,150	275.0
1906	882,345	251,050,809	284.5
1907	940,618	267,812,852	284.7
1908	987,813	261,512,214	264.7
1909	1,013,998	263,758,562	260.1

a simple calculation showing that the capacity of the individual worker was reduced by 24.6 tons. The total number of deaths in 1909 at the mines under the Coal Mines Act is returned at 1453, an aggregate that exceeds the record for any year embodied in the Government Blue books. Indeed the returns for 37 years show but one year, namely, 1878, during which this figure is even approximated, and then the deaths numbered 1413. In 1880 the aggregate was 1318 and in 1908 it was 1308.

Then again, whereas the death rate per thousand workers was 1.44 in 1900, it rose to 1.61 last year, and continuing the comparison it will be found that there were 4.49 deaths per million tons of coal raised in the former year as against 5.51 in 1909. Perhaps the comparison will be simplified by basing it upon the output per death, which is the custom in many of the States of America. When this is done the position may be reduced to the simple statement that in Great Britain in 1900 there were 222,500 tons of coal raised for each death by accident as compared with 181,527 tons in 1909. Added to this the output per individual worker was 288.6 tons in the former and 260.1 tons in the latter year.

To enable the reader to comprehend the course of events, tables may be prepared affording a 10-year comparison of the statistics. The first table relates to the position affecting labor and coal product, as follows:

Labor Overcrowded in Mines

In some measure the falling off in the product per person may be explained by the phenomenal increases in the number of persons engaged causing overcrowding in the mines, while, of course, the new labor cannot be quite so effective as the old hands, and it must also be borne in mind that some of the mines have been long in operation, resulting in the coal face being a greater distance from the shafts, involving longer journeys below ground for the men and also for the coal that is raised.

The second table prepared shows the death rates from accidents, together with the amount of coal mined per death during the period of 10 years:

DEATH RATES FROM ACCIDENTS.

Year.	Death Rate per Thousand Workers.	Death Rate per Million Tons of Coal Raised.	Tons of Coal Got per Death.
1900	1.30	4.49	222,500
1901	1.36	5.02	198,944
1902	1.24	4.51	221,762
1903	1.27	4.65	214,855
1904	1.24	4.54	220,295
1905	1.35	4.91	203,719
1906	1.29	4.55	219,834
1907	1.32	4.65	215,110
1908	1.32	5.00	199,933
1909	1.43	5.51	181,527

The Home office in its Blue books now includes tables of nonfatal accidents disabling for more than seven days, compiled from the returns which owners are required to make under Section 1 of the Notice of Accidents Act, 1906. Such tables may now be compared for two years, namely, 1908 and 1909. In previous reports it was regularly pointed out

that the number of nonfatal accidents reported to the mines inspectors was no guide to the number of nonfatal accidents which actually occurred, and had no statistical value, as the standard of severity which governed the notification of accidents allowed considerable latitude in its interpretation. Now that the seven days' disablement is the basis upon which such minor accidents are reported, the figures are more reliable for statistical purposes. Taken in the aggregate or regarded as a proportion, they are somewhat startling. Great Britain is often set up as a pattern for other nations, the claim being that the inspection of mines is superior while the colliers are assured greater immunity from accidents than the rank and file in other countries. Should there be any justification for such a claim it would be illuminating to have recorded the number of nonfatal accidents occurring in the other great coal-producing countries. That one-seventh of the working mining population should be the victims of accidents disabling for more than one week in every year is appalling, and the table covering the period of 1908-1909 will be of more than usual interest. The figures given are official and therefore uncontrovertible:

PERSONS DISABLED FOR ONE WEEK.

Year.	Persons Employed.	Persons Disabled for more than Seven Days.	Percentage of Workers Disabled.
1908	987,813	141,851	14.36
1909	1,013,998	153,306	15.11

Adding together the disablements and deaths from accident provides a total of 154,759, and as the coal product was 263,758,562 tons in 1909, it is clear upon making a simple calculation that for each person killed or injured not more than 1704⅓ tons of coal are produced.

Classification of Accidents

The accidents may be classified under various headings. As Joseph S. Martin, ex-mine inspector, says, there are pure accidents, where no blame is attributable to the deceased or those above him; accidents through errors in judgment on the man's own part, and which might have been avoided, but in which no blame could be attributed to any of the parties concerned; accidents through errors of judgment of others; accidents through incurring temporary risk, such as delaying timber setting; accidents due to pure neglect and recklessness in regard to securing places; accidents due to recklessness in other ways; and accidents due to neglect or carelessness on the part of others, including officials. Mr. Martin does not think that many of the latter occur, although they may be frequently blamable for not reporting cases of neglect or contravention of rules, with a view to punishment and the maintenance of proper discipline and safety for themselves and others.

Mine Explosion at Delagua, Colorado

Revised figures given out by General Manager W. J. Murray, of the Victor-American Fuel Company, indicate that the death list of the explosion at Delagua will reach 51. The cause of the explosion has not yet been determined. All hope of Superintendent William Lewis' party of seven being alive has been abandoned. They had just started into the main entry to investigate the fire in the mine, which was indicated by smoke pouring out of the entry, when the explosion occurred.

Report of Rescuing Parties

The report of rescuing parties showed 29 bodies in the first and second west entries, off the fourth north; 9 bodies in the eighth entry off the fourth north, and 7 in Superintendent Lewis' party caught and buried in the débris inside the main entrance. To these fatalities must be added two bodies found soon after the explosion in the fourth north entry, and three killed by flying débris just outside the main entry.

General Manager Murray thinks the explosion was due to fire in an entry, but what caused the fire is unknown. Fire bosses think the accident may have been caused by a miner being careless with his lamp and setting fire to a canvas brattice in the entry. State Inspector J. D. Jones made a preliminary examination of the mine to determine whether it was a coal-dust explosion. He found a little coked dust in the seam near where the fire started, but not enough to justify the belief that it was a dust explosion. The miners use the open style of lamp.

Explosion at Yolande Mine in Alabama

It has not been definitely ascertained whether the death of the five men killed in the Yolande mine was caused by gas or by falling slate. This mine, however, is a gaseous one, and it is the opinion of those well posted that the accident was due to an explosion of gas.

The last fatal catastrophe in the Yolande mine occurred on Dec. 16, 1907, when 56 men were killed and 31 other miners injured. This former explosion was attributed to a windy shot which started a coal-dust explosion. The explosion occurred in the No. 1 mine, 1500 ft. under the ground. About 87 men were at work in the mine when the fatality occurred.

COLLIERY NOTES

In 1898, less than 20 per cent. of the total production of coal in the United States was undercut by the use of machines. In 1908, 37 per cent. of the total coal produced was machine-mined. The number of undercutting machines in use in the bituminous mines of the United States has increased from 2622 in 1898 to 11,569 in 1908.

The twin collieries of the Bunsen Coal Company, a U. S. Steel subsidiary, now being constructed south of Clinton, Ill., will be one of the greatest plants of the kind in the world. They will employ much electrical machinery. The construction work, of concrete, will include a smoke stack 175 ft. high and 14 ft. in diameter at the top, also to be constructed of reinforced concrete.

The Keene Coal Mining Company, Yellowstone county, Montana, while it has been producing coal for local consumption for some time, has recently started to ship throughout the State and will materially increase its output. The Republic Coal Company's No. 2 mine, in the same county, has been temporarily shut down to allow the installation of a new fan and an underground car hauler.

The experiment made by the Mines Branch, at Ottawa, of placing on the local market 500 tons of peat fuel made at the Government experimental peat plant, at Alfred, at $3.25 per ton, has been attended with great success. The peat was all bought up within a few days and since then a large number of orders for further supplies have been received. The general opinion of those who have used the peat is that it is cheaper and more satisfactory than coal.

In 1907, there were 947 men killed in gas and dust explosions in the coal mines of the United States. During this same year, 343 men were injured in explosions. Falls of coal and roof killed 1122 men and injured 2141 miners during 1907. In 1908, explosions killed 396 and injured 326, while falls of coal and roof killed 1080 and injured 2591. Mr. Parker, statistician of the Geological Survey, in commenting on these figures says that they are significant, and that it is hard to make the miner see that the weakening of the roof and the fracture of the ribs by the excessive use of powder in his work are responsible for the falls, which make the long lists of casualties every year. He says further that the mining engineer knows of this danger, but that it is a hard thing to prove it to the miner; or, if he too knows it, he still assumes the risk.

MINING AND METALLURGICAL PATENTS

A CLASSIFIED LIST OF NEW INVENTIONS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COAL AND COKE

COAL CUTTING—Improvements in Coal-Cutting Machines. Anderson, Boyes & Co., Ltd., Motherwell, Eng. (Brit. No. 29,762 of 1909.)

COAL CUTTING—Improvements in Coal-Cutting Machines. Frank Eckersley, Crofton, and W. Creswick, Walton, England. (Brit. No. 22,432 of 1909.)

COKE—Art of Operating Retort Coke Ovens. August F. Hilleke, Ensley, Ala., assignor to Semet-Solvay Company, Syracuse, N. Y. (U. S. No. 973,013; Oct. 18, 1910.)

COKE—Improvements in Coke Ovens. Otto Hilgenstock Coke Oven, Ltd., London, Eng. (Brit. No. 26,125 of 1909.)

COKE—Machine for Discharging and Charging Gas Retorts or Coke Ovens. Arthur McDougall Duckham, Walden, Little Bookham, England. (U. S. No. 974,043; Oct. 25, 1910.)

COKE—Process of Coking Coals. Leland L. Summers, Chicago, Ill., assignor to Continuous Process Coke Company. (U. S. No. 968,499; Aug. 23, 1910.)

IMPURITIES IN COAL—Method of Extracting or Eliminating Sulphur, Phosphorus and Other Impurities from Coal, Ore, etc. Leland L. Summers, Chicago, Ill. (U. S. No. 967,996; Aug. 23, 1910.)

MINING MACHINE. Charles E. Davis, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill. (U. S. No. 967,885; Aug. 23, 1910.)

SAFETY LAMP—Miner's Safety Lamp. Josef Szombathy, St. Louis, Mo. (U. S. No. 973,234; Oct. 18, 1910.)

SAFETY LAMPS—Improvements in or Relating to Miners' Safety Lamps. Ernest Arthur Hailwood, Morley, Eng. (Brit. No. 24,865 of 1909.)

UNDERCUTTING—Process of Undercutting in Mines. Frank Billings, Cleveland, Ohio. (U. S. No. 974,632; Nov. 1, 1910.)

COPPER

ALLOYS—Process of Making Copper Alloys and the Product Thereof. James Naulty and John Scanlin, Philadelphia, Penn. (U. S. No. 974,419; Nov. 1, 1910.)

ELECTROLYTIC EXTRACTION — Process of Extracting Metals from Their Ores. William E. Greenawalt, Denver, Colo. (U. S. No. 973,776; Oct. 25, 1910.)

MATTE—Method of Handling Matte. William Douglas Kilbourn, Murray, Utah. (U. S. No. 974,074; Oct. 25, 1910.)

GOLD AND SILVER

CYANIDING—Improvements in or Relating to Filtering Apparatus Particularly Adapted for Use in the Cyanide Process of Extracting Precious Metals from Their Ores. W. W. Robacher, Rochester, N. Y. (Brit. No. 16,161 of 1910.)

DREDGE—Hydraulic Dredge. William F. Hunter, Arcata, Cal., assignor of one-half to Thomas Bair, Arcata, Cal. (U. S. No. 974,150; Nov. 1, 1910.)

ORE TREATMENT—Improvements in Apparatus for Treated Crushed Ore Products for the Recovery of the Metal Contents Thereof. A. J. Arbuckle, Johannesburg, Transvaal. (Brit. No. 6977 of 1910.)

STAMP MILLING—Improvements in Operating the Stamps of Stamp Mills. W. E. Kimber, Johannesburg, Transvaal. (Brit. No. 23,093 of 1909.)

IRON AND STEEL

BLAST FURNACES—Improvements in or Relating to the Treatment of Ores in Blast Furnaces. Frederick Kjellin, Stockholm, Sweden. (Brit. No. 25,244 of 1909.)

ELECTRIC SMELTING—Process for Smelting Iron Ore. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. (U. S. No. 974,608; Nov. 1, 1910.)

REFINING—Improvements in the Open-Hearth Process of Refining Steel. Gaston Barbanson and Max Lepersonne, Brussels, Belgium. (Brit. No. 5916 of 1910.)

LEAD, ZINC AND OTHER METALS

TIN—Process of Detinning. Franz von Kügelgen, Holcombs Rock, Va., and George O. Seward, East Orange, N. J., assignors, by mesne assignments, to Tin Products Company, New York. (U. S. No. 972,135; Oct. 4, 1910.)

TIN—Process of Separating Heterogeneous Substances and Detinning Scrap. Charles J. Reed, Philadelphia, Penn. (U. S. No. 971,405; Sept. 27, 1910.)

ZINC—Improvements in or Relating to the Treatment of Complex Zinc Ores. Woldemar Hommel and H. T. Durant, London, Eng. (Brit. No. 18,817 of 1909.)

ZINC—Improvements in Spelter-Condenser Nozzles. W. Rees, Swansea, Wales. (Brit. No. 22,704 of 1909.)

ZIRCONIUM—Process for the Production of Zirconium and Other Rare Metals. H. Kuzel, Baden, Austria, and E. Wedekind, Strasburg, Germany. (Brit. No. 23,215 of 1909.)

NONMETALLIC MINERALS

FULLER'S EARTH—Process for Utilizing Spent Fuller's Earth. Nathan Sulzberger, New York, N. Y. (U. S. No. 968,092; Aug. 23, 1910.)

PETROLEUM—Adjuster for Oil Wells. Lee C. Moore, Pittsburg, Penn., assignor to Lee C. Moore & Co., Inc., Pittsburg, Penn. (U. S. No. 968,181; Aug. 23, 1910.)

MINING—GENERAL

DRILLING—Rock Extractor for Drill Holes. Charles Desmarais, Quebec, Canada. (U. S. No. 973,013; Oct. 18, 1910.)

GASES—Improvements in and Relating to Apparatus for Testing Mine Gases. Joseph Smith, Dawson, N. M. (Brit. No. 5693 of 1910.)

HOISTING ENGINE. John Welker Freeman, Joplin, Mo. (U. S. No. 973,028; Oct. 18, 1910.)

MINE EXIT. Clarence W. White, Lacon, Ill., assignor of 51 per cent. to William L. Sinnott, Streator, Ill. (U. S. No. 968,504; Aug. 23, 1910.)

MINER'S LAMP. Dominick Miglio, Calumet, Mich. (U. S. No. 974,690; Nov. 1, 1910.)

ROCK-DRILLING BIT. Terrence Connell, Haverford, Penn. (U. S. No. 973,407; Oct. 18, 1910.)

ROCK DRILLS—Improvements in Rock Drills and Similar Tools. G. E. Gjuke, Stockholm, Sweden. (Brit. No. 27,474, 1909.)

SHAFT LININGS—Improvements in and Relating to Linings for Pits, Shafts and the Like. C. Walker, Gresford, Wales. (Brit. No. 21,850 of 1910.)

SHAFT SINKING—Improvements Relating to the Sinking of Mines, Shafts and the Like. Enterprise Générale de Foncage de Puits Etudes et Travaux de Mines, Paris, France, and A. Koepe, Erklenz, Germany. (Brit. No. 30,021 of 1909.)

TUNNELING MACHINE. William Russell Collins, Georgetown, Colo. (U. S. No. 973,107; Oct. 18, 1910.)

ORE DRESSING—GENERAL

CONCENTRATION—Apparatus for Concentrating Solutions in General. Eudo Monti, Turin, Italy. (U. S. No. 973,290; Oct. 18, 1910.)

CONCENTRATOR—Ore Concentrator. Eldor H. Moe, Salt Lake City, Utah. (U. S. No. 972,463; Oct. 11, 1910.)

CONCENTRATOR—Ore Concentrator. Ira F. Monell, Boulder, Colo. (U. S. No. 972,017; Oct. 4, 1910.)

CRUSHING — Ball-Mill or Comminuter Plate. Henry D. Hibbard, Plainfield, N. J. (U. S. No. 971,196; Sept. 27, 1910.)

DISTRIBUTER—Revolving Distributer for Pulp or Liquid. Edward Henry Moyle, Los Angeles, Cal. (U. S. No. 968,182; Aug. 23, 1910.)

JIG—Ore Concentrating Jig. Melvin Doubledee, Joplin, Mo. (U. S. No. 973,180; Oct. 18, 1910.)

JIGGING—Ore Jigger. Camden E. Knowles, Webb City, Mo., assignor to Webb City & Carterville Foundry and Machine Works, Webb City, Mo. (U. S. No. 973,281; Oct. 18, 1910.)

SCREEN—Revoluble Sizing Screen. Lewis E. Warner, Kellogg, Idaho. (U. S. No. 973,149; Oct. 18, 1910.)

SCREENING APPARATUS. Edward Inglis, Kofa, Ariz., assignor of one-third to M. M. Mendenhall, Kofa, Ariz. (U. S. No. 973,787; Oct. 25, 1910.)

SCREENING CONVEYER. Utley Wedge, Ardmore, Penn. (U. S. No. 973,597; Oct. 25, 1910.)

SEPARATION—Art of Separating Liquids and Apparatus Therefor. Lawrence Strom, Los Angeles, Cal. (U. S. No. 968,206; Aug. 23, 1910.)

SEPARATION—Magnetic Ore Separator. Anders Gustaf Holmberg, Langgrufvan, Sweden. (U. S. No. 972,109; Oct. 4, 1910.)

SEPARATION—Magnetic Ore Separator. Charles A. Selion, Halleck, Cal. (U. S. No. 973,984; Oct. 25, 1910.)

SEPARATOR and Classifier. Edmund Major, Maitland, S. D. (U. S. No. 973,363; Oct. 18, 1910.)

SETTLING TANK. Robert S. Lewis and John Henry Moore, McGill, Nev. (U. S. No. 973,357; Oct. 18, 1910.)

METALLURGY—GENERAL

BRIQUETTING—Apparatus for Forming Ore Blocks for the Briquetting Furnace. Gustaf Gröndal, Djursholm, Sweden, assignor to American Gröndal Kjellin Company, New York, N. Y. (U. S. No. 968,467; Aug. 23, 1910.)

ELECTRIC FURNACE. Johannes Härden, London, England, assignor to the Gröndal Kjellin Company, Ltd., London, Eng. (U. S. Nos. 967,908 and 967,909; Aug. 23, 1910.)

ELECTROLYSIS—Improvements in or Relating to the Electrolysis of Metallic Solutions. Fernand Lacroix, Paris, France. (Brit. No. 845 of 1910.)

FEEDING APPARATUS—An Improved Automatic Feeding Apparatus for Granular Material Primarily for Feeding Furnaces and Kilns. J. Gmeindl, Jos. Gmeindl, Jr., Johann Gmeindl and Alois Gmeindl, of Schnaitsee, Germany. (Brit. No. 1337 of 1910.)

FURNACE—Rotary Furnace. David Baker, Philadelphia, Penn., assignor to Ladd & Baker, Inc. (U. S. No. 968,313; Aug. 23, 1910.)

REDUCTION—Metal-Reducing Process for Volatile Metals. Frederick W. Gordon, Philadelphia, Penn. (U. S. No. 974,257; Nov. 1, 1910.)

REDUCTION—Process of Reduction of Ores Containing Sulphur and Iron. Arnold Wiens, Bitterfeld, Germany, assignor to Elektrochemische Werke, G. M. B. H., Berlin-Bitterfeld, Germany. (U. S. No. 973,732; Oct. 25, 1910.)

ROASTING—Improvements in and Connected with Rabble Shafts, Arms and Plows for Roasting Furnaces. T. D. Merton, Watford, and H. M. Ridge, Durham, Eng. (Brit. No. 3843 of 1910.)

ROASTING — Ore-Roasting Mechanism. Henry H. Bliss, Washington, D. C. (U. S. No. 968,507; Aug. 23, 1910.)

ROASTING FURNACE. Cyrus Robinson, New York, N. Y. (U. S. No. 968,265; Aug. 23, 1910.)

SLAG—Improvements in Apparatus for Granulating Blast-Furnace Slag. G. Rietkotten, Hagen, Germany, and August Kuh, Vienna, Austria. (Brit. No. 5684 of 1910.)

SLAG—Apparatus for Granulating Blast-Furnace Slag. William R. Warren, New York, N. Y. (U. S. No. 974,003; Oct. 25, 1910; also Brit. No. 4692 of 1910.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

F. W. Bradley has been visiting New York.

D. M. Riordan has returned to New York from Peru.

Arthur Winslow has been visiting Goldfield, Nevada.

F. F. Sharpless has gone west on professional business.

H. Kilburn Scott has left London for Brazil on professional business.

H. V. Winchell has just completed an examination of the East Butte mine.

Edgar A. Collins has returned to Tonopah, Nev., from a visit to the Pacific coast.

W. J. Elmendorf, manager of the Portland Canal Mining Company, was at Tacoma, Wash., lately.

A. J. McMillan, liquidator of Le Roi Mining Company, Ltd., Rossland, B. C., has gone to Chicago.

James MacNaughton, general manager of the Calumet & Hecla and subsidiary companies, is at Boston.

J. P. Hutchins, who has been for a long time in Siberia on gold-mining work, has returned to New York.

Henry G. Brown has resigned his position as president of the Maryland Coal and Coke Company, of Baltimore.

W. H. Trewartha-James, of Victoria, B. C., general manager of the Tyee Copper Company, is about to visit New York.

S. W. Eccles has been chosen president of the Nevada Consolidated Copper Company, in place of James Phillips, Jr., resigned.

H. W. Turner, who has been on professional business in Siberia, is returning home by way of Moscow, London and New York.

W. M. Brewer recently returned to Victoria, B. C., from Alaska, and went thence to Sheep Creek camp, in Nelson mining division.

S. S. Raymond, of Los Angeles, Cal., lately spent a week examining gold-mining properties in Sheep Creek camp, British Columbia.

W. H. Aldridge, managing director of the Consolidated Mining and Smelting Company of Canada, Ltd., has returned from eastern Canada.

S. E. Bretherton, who is doing professional work in the State of Sonora, Mexico, expects to return to San Francisco early in December.

Mark R. Lamb, of the Allis-Chalmers Company, sailed from New Orleans, Nov. 4, for an extended trip through the principal mining countries of South America.

R. H. Chapman, of Washington, and C. H. Clapp, of Boston, are completing their season's field work on Vancouver island, B. C., for the Geological Survey of Canada.

G. I. M. Simons, editor of the *Celcgraaf*, of Amsterdam, Holland, spent several days recently in the Birmingham district, in Alabama, looking at the properties of several industrial companies in which Holland money is invested.

Edmund D. Jermyn, of Scranton, Penn., has been chosen vice-president and general manager of the Rhode Island Coal Company. The mines at Portsmouth, R. I., will be in charge of H. D. Johnson, late of Scranton, as superintendent.

S. J. Lewis, who has been engaged in geological work for the Cinco Minas and other companies in the Hostotipaquillo district, of Jalisco, has accepted the position of consulting engineer for the Amparo Mining Company, at Etzatlan, Mexico.

The John Fritz medal, established in 1902 in honor of Mr. Fritz on his eightieth birthday, has been awarded for this year to Alfred Noble, past president of the American Society of Civil Engineers, "for notable achievements as a civil engineer."

Sir Robert Hadfield, of Sheffield, Eng., has been awarded the Elliott Cresson medal for 1910 by the Franklin Institute, of Philadelphia, for "distinguished, leading and directive work in the advancement of our knowledge of metallurgical science."

W. F. Harrison has resigned the management of the Inde Gold Mining Company, at Inde, Durango, Mexico, and has been placed in charge of properties in New Mexico, owned by the same people. R. McCart, now assistant manager, will succeed Mr. Harrison at Inde.

Walter Brinton, superintendent of the manganese steel department of the Taylor Iron and Steel Company's plant at High Bridge, N. J., since 1895, has resigned, and has accepted a position as consulting engineer for the Edgar Allen American Manganese Steel Company, which is manufacturing manganese steel at Chicago Heights, Ill., and at New Castle, Del. Mr. Brinton's headquarters will be at the New Castle plant.

OBITUARY

John R. Lockhart was found dead near Palmarito, Durango, Mexico, Nov. 29. It is believed that he was murdered several days before. He had been employed as a mining engineer in Mexico for several years. Before going to Mexico he was in the Joplin district in Missouri.

Charles H. Tucker died Oct. 30, at Clifton Springs, N. Y., where he had gone for his health. He was 50 years old. He was born in New York, and after some office and newspaper experience he entered the New York office of the John A. Roebling's Sons Company, growing steadily in their service until 1898, when he was secured by the A. Leschen & Sons Rope Company, Ltd., with whom he remained until his death. He was secretary and treasurer of that company. During his connection of 26 years with the two companies, he became one of the best informed and extensively known wire-rope men in this country. In Mr. Tucker was exemplified a rare versatility wherewith as an Eastern man trained to manhood in Eastern business practice, he was enabled to adapt himself to Western methods and utilize them with large success.

Edwin J. Hulbert died at Rome, Italy, Oct. 20, aged 81 years. More than 50 years ago he was one of the pioneers of the Lake Superior region, and to him is given the credit of the first discovery of what is now the Calumet & Hecla mine. In 1854, when he was employed on the survey of the State road from Copper Harbor, by way of Eagle Harbor, Cliff and Houghton, to Ontonagon, the first discoveries of stray conglomerate copper-bearing boulders were made. In August, 1864, he directed two woodmen in his employ, named John Hulbert, Jr., and Amos Scott, to sink a pit at a given point upon the lands which he had purchased in 1860. There the discovery of the Calumet conglomerate lode was made, at the location now marked by Calumet No. 4 shaft. Mr. Hulbert was an engineer of ability and an energetic man, but he was not a business man, and he secured little or no reward for his discoveries. He retired a number of years ago, and for several years had been in feeble health.

SOCIETIES and TECHNICAL SCHOOLS

National Association of Cement Users—The seventh annual meeting will be held in New York, Dec. 12-17. Headquarters will be at the Prince George hotel. A large number of papers and committee reports on various subjects will be presented.

Mining and Metallurgical Society—The following have been elected to membership: Henry S. Drinker, Walter Fitch, John T. Fuller, Louis D. Huntoon, Sidney J. Jennings, B. B. Lawrence, R. V. Norris, Joseph A. Van Mater, R. G. Brown, Benedict Crowell, James S. Douglas, E. F. Eurich, B. B. Gottsberger, Robert Peele, D. M. Riordan, Bradley Stoughton. The New York section held its regular monthly meeting at the Engineers' Club, on Nov. 17 and in order to continue the discussion, which was on the report of the Committee on the Prevention of Mine Accidents, an adjourned meeting was held on Nov. 22. The report excited much interest.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

Nov. 19—The oil men of the State are much pleased that both Secretary of the Interior Ballinger and Assistant Secretary Pierce have visited the California oilfields this summer, and have a better idea of the local conditions than before. They think as a result of this that some of the withdrawn lands will be again opened to entry and that there will be a change of rulings as to locations and patents. The California delegation which went before Congress early in the year think there was ignorance on the part of members of both Houses and the bureau officials, on the subject of petroleum and petroleum lands, but this has been to some extent eliminated. Still, in their zeal to improve matters relating to oil lands, the California oil men are also showing an ignorance about locations of gold placers which is less excusable than that shown by congressmen and bureau officials.

The Yard decision is the principal topic of discussion and relief from present conditions is expected from a reversal of that decision. In that case it was decided that an assignment of eight separate placer locations of 20 acres each to an individual or company before discovery of valuable mineral on each tract, was void. This principle when applied to oil lands played havoc with speculation or even legitimate work. The oil men, however, do not seem to know that it had been doing damage to gold mining for years even before enunciated so strongly in the Yard case, which was really a special one involving an intimation of locating timber land as mineral.

And now the oil men, in making their arguments for a change, take the strange position of asserting that 20 acres is plenty of land for a gold placer but is not enough for an oil location where money has to be spent to find the oil in advance of actual discovery. They forget that in the case of drift or hydraulic mines, which are placers under the law the same as oil lands are, much more than 20 acres in a single piece is required, and that men will not invest in them unless a larger acreage than 20 acres can be combined in one tract. The conditions are almost precisely the same with these classes of gold placers as they are with oil locations. And yet the oil men are telling the bureau officials that 20 acres is plenty for a gold placer but a larger unit is necessary in the case of oil. They are doubtless thinking of the old-fashioned surface placer of early days, and know nothing of the conditions involved in drift and hydraulic mining.

In drift mining particularly, the rule of showing paying mineral works such hardship on the locator that the industry is rapidly declining and few new mines are being opened. These drift mines are mainly in the buried channels of dead rivers covered with lava capping many hundreds of feet deep. It is impossible to show value on the surface of this lava. To develop the channel long tunnels must be run and until the tunnel reaches the channel, no values can be shown either. Thus under present rulings there can be no valid location of a drift mine. Moreover, no one is going to run a tunnel several thousand feet long to work only 20 acres of ground and they can get no patent until they can show the auriferous gravel in the channel. Then if they cannot combine more than one location when applying for patent it is useless to do so because under the Yard ruling they must show value in each separate tract, and this is impossible until the mine is worked out.

While the oil men have an organization to present their side, the gold miners have not, for which reason the oil men should be more careful in making statements such as they have with regard to gold-placer locations of 20 acres being enough for the gold miners. It betrays an ignorance of general mining conditions not at all commendable for men engaged in any branch of the industry in California. If the gold miners got together to present their views of the case before the officials, the oil men would be placed in a bad position as themselves showing ignorance of a subject they have charged the officials with being ignorant of.

Denver

Nov. 20—Apparently the deep-drainage tunnel at Cripple Creek has entered the breccia area, and the flow of water does not exceed 1000 gal. per min. At a meeting of the directors, the contractor was authorized to drive 200 ft. further, unless a flow of 2000 gal. per minute is secured inside that distance, when the contract will be considered completed. The total length of the tunnel is now 15,524 ft. The present cost is $28 per ft., and $23,000 of the total subscribed, amounting to $550,000, is still in the treasury.

The long tunnel which has its portal in Cottontail gulch, just below the town of Cripple Creek, with its course through Gold hill, and its heading under Raven hill, and which is called the Ophelia tunnel, but more generally known as the Moffat tunnel, after its original owners, has been sold by the master in chancery to William Faxon, of Boston, for $24,000. This was a foreclosure sale on behalf of the bond holders. The value of the property is rated at $327,000.

The case of the Government against the promoters of the Lost Bullion-Spanish mines, in which seven defendants were either fined or given jail sentences by Federal Judge Lewis, is again delayed. After waiting three years for a decision on the appeal, it is now said that the Court of Appeals may pass the case up to the Supreme Court of the United States, which means two years more.

Butte

Nov. 18—John Hardie, a metallurgist of Helena, Mont., claims to have invented a method of greatly intensifying the heat in a blast furnace. Patents have been procured and money raised to erect a smeltery at Rimini so that the method may be given a thorough tryout.

Information has recently been given of the intention of the Chicago, Milwaukee & Puget Sound Railway Company to build a line to Libby, the county seat of Lincoln county. The exact rounte of the line has not been made public. The country which the road will tap contains valuable timber and in the vicinity of Libby there are many mines which could be placed on a paying basis with the advent of a railroad.

Salt Lake City

Nov. 19—The production of lead and silver in Utah has been less than usual during several months. The Park City district has shown a falling off on account of the decreased output of some of the largest producers. The Daly-West and Silver King have marketed less ore than normal, the former on account of its new development policy on the lower levels, while the latter has been installing an electric haulage system, and it will probably be Jan. 1 before regular shipments are resumed. The Tintic mines have marketed much less lead-silver ore than during 1909. There has been a substantial increase in the production of this class of ore in the Bingham district, but this ore is not as high grade and does not carry as much silver as is contained in the Tintic or Park City ores. The increased production of Bingham has not balanced the lessened shipments from Tintic. The smelters have felt the short-

age of lead ore to a great extent, and have been bringing in as much ore of this character as possible from outside of the State.

During October, the Snake Creek drain tunnel, near Park City, was driven 304 ft. On Nov. 1 the tunnel was in 1734 ft. Some water has been encountered, but has not interfered with operations. So far timbering has not been necessary.

The Utah Apex mill at Bingham was closed Nov. 10, and the mining force put on the development of three new and important orebodies. There is no truth in the reports that an injunction was obtained by the Bingham Copper Company, or that the ore supply was insufficient to keep the mill going. The reason for the shutdown was due to the limited capacity of the compressor, which was unable to furnish enough air for the extraction of ore and the development at the same time. The pressure at the drills was not high enough to make good progress in the quartzite. The reserves are ample to keep the mill running for a year or longer without any further development. A new body of ore running well in copper and silver was cut recently on the seventh level. In this property both lead and copper orebodies occur in the same neighborhood, though making from an entirely different system of fissures. On Nov. 6 a new strike of fine-grained silver-lead ore was made from a raise above the seventh level. A third strike of silver-lead ore has also been made on the Parvenue tunnel level. Development is being pushed on these new orebodies, and mill operations will be resumed when this work is far enough advanced, which will probably be at an early date. During October, 150 tons per day were sent through the mill, as two shifts only were worked on ore. About 1200 tons of first-class and concentrates were shipped. The normal capacity is 170 to 190 tons of mill ore daily, and from 1200 to 1800 tons of first-class and concentrates per month.

Morgantown, W. Va.

Nov. 12—The State Mines Department reports the total production of coal in West Virginia for the year ended June 30, 1910, at 52,723,708 tons. Details have already been published.

Investments in coke-manufacturing plants in West Virginia increased during the past year $3,610,991, or 81 per cent. The coal output for the calendar year 1910 is expected to land the State permanently in second place among the coal-producing States.

There were 320 men killed and 941 injured in the mines of the State during the year ended June 30, 1910. The number killed is less in comparison with the tonnage produced than any previous year records except in three instances. While it is to be regretted that so many non-fatal accidents occurred, this in a measure is explained by the fact that the present chief of the department has insisted upon the district mine inspectors following up the accidents and reporting them to the department no matter how slight the injuries were. Heretofore the inspectors allowed the minor accidents to pass without reporting them.

The State Department of Mines is taking drastic measures to put a stop to the practice of shooting from the solid. Twenty miners were arrested one day recently in the southern part of the State charged with this offense, and had to pay fines ranging from $10 to $17 each. A mine foreman who connived at the violation of the law was fined $50.

The committee selected by the West Virginia Mining Institute and the State Board of Trade on "Development and Protection of the State's Resources" and on "Prevention and Protection of the State's Coal Beds from Dangers Attendant Upon Drilling Through Them for Oil and Gas," met at the capitol and conferred with Governor W. E. Glasscock recently.

At present, West Virginia has no law on the statute books that will protect the coal overlying the oil and gas bodies and in several instances, it is claimed great damage has been done to the coal companies holding coal leases. The committee was of the opinion that there should be a law requiring the proper marking and recording of all oil, gas and deep wells in the office of the county clerk in the countries in which the wells are drilled, and that a proper marker be placed where the well is located in the event it is abandoned. By such a method coal men could easily locate such wells and be governed accordingly in the planning for the development of their property.

In this same connection, the proposed law will require that the wells be properly cased to prevent the escape of gas, water or oil through the coal veins, and also that the coalowners, if they are not the ones who hold the oil and gas rights, shall be paid a certain sum for the loss of coal that must be left standing around the wells in order to prevent the escape of gas, oil or water into the mines.

The Norfolk & Western opened bids lately for new construction in Virginia and West Virginia which will cost about $3,000,000 and take two years to complete. The plans include a four-mile extension of the Tug Fork branch to reach holdings of the Pocahontas Consolidated Collieries Company, near Elkhorn, that are soon to be developed. The bids covered an extension of the Dry Fork branch to a point on the Clinch Valley division about 14 miles from the present terminus. The cutoff between the main line and the Clinch Valley division thus established will afford a shorter route for west-bound tonnage from the Clinch Valley, which at present reaches the main line at Graham, near Bluefield. Incidentally, it will open up the property of the Faraday Coal and Coke Company—a subsidiary of the H. C. Frick Coke Company—on the boundary line between Virginia and West Virginia.

Cobalt

Nov. 20—The final plans for the new Porcupine railroad have been completed and men are now engaged in cutting out the right-of-way. The junction with the Temiskaming & Northern Ontario will be between mileposts 224 and 225, where there is a good site for a town. Arrangements are being made for a new townsite at the Porcupine end, where the railroad company will erect a hotel.

Surface prospecting on the Nipissing has been stopped for this season. In all 167,446 ft. of work has been accomplished, all in the conglomerate and Keewatin formations, with the result that two high-grade veins were found in the former, and 11 veins, six of which carried high-grade ore were found in the Keewatin. At the end of the season the following acreage still remains unrsospected: Conglomerate, 123 acres; Keewatin, 10 acres, and Diabase, 225 acres. During September this company produced 351,349 oz. of silver, having a value of $185,219.

London

Nov. 15—Shareholders in New Kleinfontein, hitherto one of the steadiest producers on the Rand, have been unpleasantly reminded of the uncertainties of even Rand mining by the sudden drop in the market value of their shares from 50s. to 40s., while other shares in the same field remained steady. For the two years the annual dividend has amounted to 20 or 25 per cent., and the market value of the shares has been steady. The cause of the sudden drop in the latter could not be attributed to any general market depression. It became evident, however, when an official statement was subsequently published, notifying that the grade of ore crushed was to be reduced from 7½ to 7 dwt., a reduction of 20 per cent. in the profits to be won from over a million tons in sight. Shareholders have a right to feel aggrieved at the first intimation of something being wrong coming through the fall in the market price of the shares, showing that some persons must have had information of the purport of the official statement before it was made public.

Mexico City

Nov. 16—The National Railways has restored the former 2-peso switching charge rescinding the 5-peso rate which practically prohibited the movement of ore in some of the low-grade camps. The order particularly affected the Parral district which is now again active, due to the completion of large cyanide mills to treat the low-grade ore.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alaska

For the first 10 months of 1910 there has been received in Alaskan gold at the Seattle branch of the U. S. Assay Office, $9,353,145, all of which has been produced in the placer fields of the north. This is divided as follows: Nome, $3,482,548; Tanana, $4,141,407; Iditarod, $787,497; elsewhere in Alaska, $803,620.

Latouche—The largest copper-ore shipment from the Cordova section was recently made from the Latouche mines. It consisted of 1800 tons.

Alaska United—For the month ended Oct. 15 total crushing of the R. B. and 700 mills was 35,087 tons, total production $86,237, total net operating profit $23,726. The ore averaged per ton $2.198 and $2.39.

Arizona

Cochise County

Directors of the Calumet & Arizona and Superior & Pittsburg met at Calumet, Mich., Nov. 23 to consider merger plans.

Gila County

Ray Consolidated—According to President Aldrich, of this company, the expenditure for development and equipment by Jan. 1, 1911, will amount to $6,000,000, and when all is completed, the total will be between $7,500,000 and $8,000,000. The latter figure will be relatively low, even if the plant now under construction able to produce the 80,000,000 lb. of copper annually that is contemplated.

Santa Cruz County

Elephant Head—This property, in the Santa Rita mountains, will be operated by Benjamin Daniels, of Nogales.

Yavapai County

Glore—The group on the Hassayampa, about 12 miles above Wickenberg, has been optioned to Browne & Myers. Robert H. Browne will assume charge.

United Verde Extension—The company has ordered from Los Angeles a 72,000-gal. per day pump. The mine is now making from 20,000 to 22,000 gal. of water per day.

Hull—At the annual meeting, Oct. 3, G. W. Hull, president, reported that the company had run 250 ft. during the year. The directors were authorized to raise money by bonds or notes, to cover the indebtedness of $47,724, mainly due to the president, and for working expenses.

California

Amador County

Hardenburg—The shaft started on this mine, east of the old one, will be sunk to 2000 feet, with three compartments.

Central Eureka—Four levels have been opened in this Sutter Creek mine, showing enough ore to keep the 20 stamps going.

Lincoln—In reopening this mine at Sutter Creek, an immense amount of water has been removed, as it is connected with both the Wildman and Mahoney properties. The shaft has now been cleared 240 ft. An electrically driven turbine pump is in use.

Butte County

After prospecting the ground on the Speedway park section, south of Oroville, it was found that there was not enough gold to warrant a dredge.

Calaveras County

North Star—At this property, at Angels, the company is installing a 20-stamp mill.

Gold Cliff—A 20-stamp mill has been completed at this mine, at Angels, owned by the Utica company.

Waterman—High-grade ore has been recently struck in this mine at Angels, under bond to J. F. Curtis, of Stockton.

Eldorado County

Starkey—This mine, near Omo, has been purchased by Charles Edner and A. G. Kullburg, and is being developed.

Fresno County

Fresno Magnesite Company—The company has commenced operations. A warehouse, 150x35 ft., has been finished; the new crushing plant is working satisfactorily. F. R. Bachler is manager.

Eliza Jane—At this gold mine, Hughes creek, a 20-ton cyanide plant has been installed. J. Hoxie is manager.

Humboldt County

Humboldt Copper Company—After much prospecting this company, at Horse mountain, has found what is believed to be the main vein of copper ore.

Inyo County

Villareal—In doing assessment on the property of this company, 15 miles south of Keeler, a 20-ft. vein of silver-lead ore has been found, thought to be on a continuation of the Cerro Gordo silver-lead belt.

Mendocino County

Harold Ravenholdt has bonded the Davidson ranch, three miles west of Willits and commenced development on a gold-silver vein.

Mono County

Leasers on the Blind Spring Hill mine, at Benton, have made a strike in the old workings. The cyanide plant of Remington, Musser & Eaton has been completed.

Casa Diablo—A cyanide plant and a tube mill are being provided for this mine, 25 miles from Benton.

Nevada County

Arctic—This mine, at Washington, will be opened by Los Angeles men with J. P. Flint in charge. A new lower tunnel will be run.

Coon—This mine, at Nevada City, has been bonded to C. D. McGonigal and a new shaft will be sunk. A 10-stamp mill is being built and machinery placed on the shaft.

Zeibright—At this property, Bear Valley district, J. H. Patrick, superintendent, the men are taking out ore to keep the 10-stamp mill busy, and a larger mill is talked of.

Cassidy—A shoot of pay ore has been found in the 250 level of this Grass Valley mine, adjoining the Empire.

Placer County

Evening Star—At this mine, near Auburn, being reopened by W. H. Gallagher and Wheeler Riley, new hoisting and pumping plants have been installed.

Plumas County

The Sunnyside, Nelson Creek, has developed a rich body of gravel in a tunnel 975 ft. in length. In the Burnham claim a shaft is being sunk to bedrock to find its depth, with a view of starting a tunnel to open the Sunnyside channel on the west. The Gibraltar company has a 300-ft. shaft to bedrock from which it is running a tunnel for the gravel channel. A number of copper claims have been located in this section recently. Peter Spaich, in drifting an old hydraulic claim on the creek, has struck gravel of high grade.

Engells Brothers and associates who have been building a 100-ton copper smeltery near Greenville, Plumas county, have it nearly completed. The copper found in that vicinity is of high grade but distance from transportation facilities has kept the mines from being developed. Now that the Western Pacific railroad is running through the county, machinery may be brought in and ores carried out. The smeltery and mines are about 16

miles from Keddie on the Western Pacific. The section around Greenville and Indian Valley has many copper veins and on some of these development has been going on for some time.

SACRAMENTO COUNTY

Natomas Consolidated—The pit has been commenced in the Rebel Hill section of the Folsom field for the dredge Natomas No. 9, which will be of the largest size.

SAN BERNADINO COUNTY

Orange Blossom—John Denair has bought this property, near Bagdad, for $23,638 from the trustee. San Diego capital will develop the property.

SIERRA COUNTY

Kate Hardy—The Los Angeles men who had the bond on this mine, at Alleghany, have failed in their payments and it has reverted to its owners, William Beggs and Captain Morrell.

Chipps—At this property, Sierra City, L. H. Holley, superintendent, the new 10-stamp mill has been started.

TUOLUMNE COUNTY

Ida Kline—At this mine, near Stent, under bond to Louis Beddig, grading is on progress for a 20-stamp mill.

Tarantula—Work on the 20-stamp mill is well under way and a small force of men is working in the mine.

Manganate—A Sacramento company has taken a large block of stock in the Central Mother Lode Mining Company, owning this mine, and it is expected that work will be resumed.

Colorado

In the early part of 1910, the building of four small smelteries in different parts of Colorado was noticed in the JOURNAL, with the prediction that they would probably "die aborning." Two have already done so: the Modern smeltery, at Utah Junction, and now comes word that the Künzel smeltery, at Buena Vista, which advertised so largely all through the San Juan region, has passed into the hands of a receiver appointed by the Chaffee County district court. The Partridge hot-blast smelting furnace and the Malm process are now aspirants for recognition.

The county of San Miguel is producing vanadium ore from a deposit which extends from Newmire to Brown, on the Rio Grande Southern, about 10 miles in length, and it is reported that representatives of foreign steel works have, during the last six weeks, arrived at Telluride, and are busy looking up the vanadium deposits on the San Miguel river and Fall creek.

BOULDER COUNTY

White Raven—In this mine, at Ward, a strike is reported of native-silver ore, also high in gold.

Caribou—What is believed to be the Eureka vein of this historic group (credited with a production of 10,000,000 oz. of silver in the early days) has been intersected by a tunnel 1100 ft. in the mountain, and at 700 ft. below the surface. Four feet of ore was struck worth $35 to $40 per ton.

Wolf Tongue—This mine is said to be shipping car lots of 60 per cent. tungsten concentrates from the mill at Nederland.

CLEAR CREEK COUNTY

Refugee—One hundred tons of ore from this property, which is worked through the Central tunnel have been shipped by Downing & Co., lessees, to the Hudson mill. It gave returns of $16.50 per ton net. There are 800 tons of ore broken in the mine, and ready for shipment.

Albro—One hundred tons from this mine have just been received and treated at the Jackson mill, and it gave returns of $12 per ton net.

Standard—In this mine, on Fall river, under lease to Straub & Co., it is reported that 3 ft. of ore, worth $60 per ton, has been opened, and shipments will commence at once.

Treasure Vault—The last clean up on this mine realized $3147 for the lessees. It will now be operated on company account. Angus Sutherland is superintendent.

Revenue—Lewis Rebo, leasing this mine, on Silver mountain, has opened an 18-in. streak of ore said to carry 400 oz. silver per ton, and 18 per cent. copper.

Red Oak—In the Asteroid mine of this company, on Democrat mountain, the lessee is stated to have made a strike of 2 ft. of lead ore, assaying 400 oz. silver per ton.

Shafter—A foot in width of ore yielding $150 per ton has just been opened in this mine by Schreiber & Co., lessees.

Old Town—In October, ore was shipped from this mine, which yielded $3000 to Pike & Co., leasers. Hutchings & Co., leasing on the same mine, are shipping a carload a week, which runs $50 per ton at the smeltery.

LAKE COUNTY—LEADVILLE

The Portland Gold Mining Company has notified Cripple Creek shippers that the old treatment rates will be restored, as it has been found there was no profit in treating custom ores at the charges in effect during the last few weeks.

Stevens—In mining the carbonate of zinc discovered a month ago, Thomas Smith, lessee, is reported to have run into 4 ft. of ore carrying 60 per cent. lead.

Dunkin—A cave in this mine, on Fryer hill, exposed a body of sand carbonates, carrying 60 per cent. lead, with high silver.

Aztec—Supplies for the winter are being sent up to the mine in South Evans gulch, and a shaft is being sunk.

Robert Emmet—The leasers on this mine, in Stray Horse gulch, have suspended zinc-ore shipments temporarily, in order to attack the ore from below, and thus extract it more economically.

Hill Top-Last Chance—In this mine, in the Horseshoe district, a large body of high-grade carbonate of zinc has been discovered. Under the zinc is found a lead ore running well in gold and silver. John Berger is the leaser.

Forest City—W. A. Young, lessee of this mine, on Carbonate hill, has been shipping steadily from a body of iron ore, in developing which lead ore was uncovered, running well in silver.

Tiger—In mining this property, in Sugar Loaf, in the early '80s, ore that did not carry $50 per ton was thrown over the dump. John Herbert has now secured a lease on the old dumps, and has shipped his first car.

Yak—A report is that in one of the properties operated through this tunnel a body of sulphide ore has been opened from 60 to 70 ft. wide, with heavy stringers of silver glance all through it.

TELLER COUNTY—CRIPPLE CREEK

Owing to the largely increased shipments from Leadville, resulting from the discovery of bodies of zinc ore, the shortage of cars has caused several of the companies to curtail their output.

El Paso—Rich ore continues to be struck by leasers in the upper levels of this mine, and it is stated that everything is ready to split the casing in the borehole at the bottom of the main shaft, which releases the waters into the deep-drainage tunnel, and unwaters the lower levels of the mine, where the richest ore is said to be.

Golden Cycle—The statement is now made that this company, which paid its last dividend in 1905, will pay a dividend of 1c. per share next month. The mine is credited with having a treasury reserve of $1,500,000. A large amount has been spent in development and surface improvements.

Indiana

MONROE COUNTY

The Standard Oil Company has obtained leases on 5000 acres near Elliottsville and is putting down test wells. The prices paid for two-year leases ranged from $200 down, the landowner to receive the usual royalty of ⅛ of the production.

VIGO COUNTY

The Mines Bureau mine-rescue car has created considerable interest in this district. The first-aids methods are so practical and successful as to occasion the Terre Haute fire department to take

steps to adopt the helmet supplied with oxygen for rescue work of persons inside of burning buildings.

About 1000 miners employed in the Wabash, Riverside, Lower Vein and Pittsburg mines refused to work several days last week because the train on which they made their daily trips to and from the mines was not heated. The operators say the miners will be fired under the agreement for striking where no notice or complaint is given of a grievance. The train is now being heated and the miners have returned to work.

WARRICK COUNTY

Menden—Fire which has been burning for three days threatens to destroy this coal mine, on the Southern railroad three miles west of Booneville. The fire was found near the main sump when miners were ready to descend. Attempts to get near it with an extinguisher failed. The mine was immediately sealed, and the only hope now is that the fire will be smothered. C. H. Menden, proprietor of the mine, has asked for the assistance of the United States mine-rescue car and experts now in Indiana. The Menden mine is one of the oldest in southern Indiana and employs a large number of miners.

Michigan

COPPER

Oneco—Preparations are being made to unwater the shaft, preparatory to resumption of sinking. This shaft was opened a number of years ago to 500 ft. and owing to the difference in the pitch of the shaft and that of the formation it pased out of the lode. Cores from greater depth show the formation well mineralized.

Houghton—The shaft at this property is down about 100 ft., sinking in the footwall of the Baltic lode, and the formation is so badly broken that it is necessary to keep lining the shaft with concrete as sinking progresses.

Gratiot—This subsidiary company of the Calumet & Hecla continues rock shipment to the mill from the openings of No. 1 shaft and the stock pile of No. 2. No. 1 shaft is sinking on the Kearsarge lode below the 17th level; the two lowest drifts, 13th and 15th levels, are opening a good grade of rock.

Hancock—The surface equipment at this company's No. 2 shaft will be completed within the next few weeks and rock shipment will begin to one of the mills in the district, probably the Allouez-Centennial or the Franklin, after Jan. 1. The openings on the No. 3 lode tributary to No. 1 shaft continue encouraging; a winze on this lode is sinking below the 18th level.

Isle Royale—Exploratory work at "A" shaft on the Baltic-Superior lode continues in the form of drilling. The third hole from the 700-ft. level is under way; this hole is being driven westward. The first hole was driven eastward to the sandstone without showing copper and the second was sunk for a distance on the formation without revealing copper.

La Salle—The company has discontinued operations at its No. 5 shaft (No. 1 shaft on the Caldwell tract), condition at that point being unsatisfactory. Operations continue at No. 1 shaft, which is down below the 19th level with good ground being opened tributary to it, and at No. 2 shaft down about 1000 ft. Rock shipments of about 150 tons of rock daily are being made to the Allouez-Centennial mill.

Seneca—Drifting at the 920-ft. level shows a very good run of copper rock. This is encouraging as the openings above this point have failed to reveal anything.

Montana

BUTTE DISTRICT

Anaconda—The new Gagnon shaft is now down 1050 ft. An air hoist is being used for sinking. At the Tramway mine the daily shipments now average about 1150 tons, while from the Rarus, which a year ago was producing about 700 tons daily.

La France—The Lexington mine and the dry concentrator have both been shut down for nearly a year, up to which period leasers were working in the mine. The Lexington contains a large body of zinc ore which may possibly be mined when the Butte & Superior company's proposed concentrator is erected.

Butte & Superior—The east side of the main hoist, which was wrecked, has been repaired and both sides are now in use. About 450 tons are being shipped daily. The latter part of October, a 1000-ton shipment was made to the Butte Reduction Works for test, but no information concerning the results has been given. Plans for the 500-ton concentrator have been completed. The mill will be built just below the present surface plant on an incline. For water supply the flow from the North Butte Extension shaft will be utilized as well as several surface appropriations.

Butte Central—The sinking the shaft 500 ft. deeper has begun.

BROADWATER COUNTY

Keating—The new shaft is down 600 ft. and a drift is being run from the bottom. Ore is being hoisted from the 500-ft. level and on the 400-ft. level the drift is in over 1000 ft. from the shaft. During October daily shipments averaged 100 tons, averaging $19 per ton. The electric power in use has materially cut down operating expenses but the ore is still being hauled 14 miles by team. It is expected that a railroad will be built which will connect directly with the mine.

GRANITE COUNTY

Southern Cross—The management states that the mill at Georgetown, now being overhauled, will be ready Nov. 23. The mill is being remodeled under the direction of John Randall and the Moore filter process is being installed. The mill will have a capacity of 150 tons daily and will first treat the ore on the dump.

JEFFERSON COUNTY

Corbin Copper—Pres. Stephen R. Dow reports that the concentrator is operating satisfactorily and that it will be run continuously as soon as the Bonanza workings are connected with the Dewey. The Bertha vein has been cut at 900 ft. and is 6 ft. wide and shows good ore. This is the deepest work in the camp. About 14,000 ft. of tunnel has been driven.

LEWIS AND CLARK COUNTY

At the Flora mine in the Lump Gulch district work of deepening the shaft will be begun shortly and when completed shipping will begin. The shaft on the Hope Quartz claim, down 300 ft., will be sunk 100 ft. At the property of the Progress Mining Company, which acquired the Towsley group north of Marysville, eight men are extending the main tunnel. A mill is planned.

Caroline Mining Company—Preparations are being made to sink a 500-ft. shaft on the property in Grizzley Park, near Helena.

Nevada

CHURCHILL COUNTY

Nevada-Wonder—This company in its annual reports announces that contracts for a 100-ton mill and for power have been let. An issue of $300,000 of 6 per cent. convertible bonds has been authorized to meet due obligations and for working capital. The property is at Wonder. C. A. Higbee is president.

WHITE PINE COUNTY

Giroux—Pres. T. F. Cole announced in Ely that the company would erect a smelting plant in the district to treat the Giroux ore.

Nevada Consolidated—At a special meeting of the directors S. W. Eccles was elected president, succeeding James Phillips, Jr., and D. C. Jackling was elected vice-president. Executive committee now consists of S. W. Eccles, Murray Guggenheim, C. M. MacNeill, Charles Hayden, S. R. Guggenheim. Daniel Guggenheim was elected chairman of the board of Nevada Northern Railway Company. S. W. Eccles was elected president, and D. C. Jackling vice-president.

New Jersey

Pahaquarry Copper Company—This company, operating at Calno, Warren county, is making preparations to start a 200-ton concentrator, just completed. The

concentrator has been electrically equipped. George O. Deshler, Dumfield, is engineer in charge.

New Mexico

Chino—Hayden, Stone & Co., say: "The report for October shows an increase during the month of 1,293,038 tons of "fully" developed ore, and 433,445 tons of "partially" developed ore, a total of 1,726,483 tons. The increase in the tonnage was mostly in the Hearst-Air Shaft-Carasco section, and the new holes on which this increase was based were in unusually rich ground, so that the increase of 1,726,000 tons raised the grade of the whole orebody from 2.58 per cent. to 2.60 per cent. The company has now a total of 30,671,827 tons of ore, averaging 2.60 per cent. copper. The company has, to date, drilled 364 holes, with a total footage of over 130,000 feet."

Grant County

Pinos Altos—The timbering in the Hearst shaft took fire on Nov. 7 and endangered the men below for a time. The Altos Pinos is under option to Corrigan, McKinney & Co., of Cleveland, and was recently inspected by James Corrigan, Captain Murray and R. B. Hutchinson.

Otero County

At Oro Grande the placer plant on the Boston-Jarilla company is being operated by J. J. Murray. Steam scrapers are in use to move the gravel. The Eureka company of Boston is sinking on the Mollie Gibson and Amarillo. An iron property near Oro Grande is being explored.

Oregon

Baker County

Mormon Boy—This property has been leased to Sidney Love, of Sumpter, who will start development at once.

South Dakota

Portland—Superintendent H. S. Vincent announces that the company may operate the recently required American Eagle cyanide mill after Jan. 1. Additional filtering and slime capacity will be added.

Tennessee

Tennessee Copper—The company will issue $1,500,000 6 per cent. first mortgage bonds, authorized by stockholders at a special meeting. This will retire all its outstanding obligations, and place additional working capital in the treasury.

Utah

Iron County

A large amount of assessment work is being done on claims between Deer Lodge and Gold Springs this year. A boom is being looked for in the district, on account of the successful operation of the power plant of the Gold Springs Mining and Power Company. It is expected that much new work will be started.

Gold Springs Mining and Power—Although there was some difficulty in starting operations, the power plant at Modena is reported to be working smoothly. The new equipment at the Jennie mine and mill is in use. About 60 tons of ore a day running around $7 in gold and silver is being sent through the mill, and this tonnage will be increased. A cleanup of 100 oz. of amalgam per day, averaging $2 to $4 per ounce, is reported. The tailings from the Nissen stamps and plates are treated in the cyanide plant. A crosscut is being driven west on the 300-ft. level to the Talisman vein, the outcrop of which can be traced for over 1000 ft. Ore running as high as $30 per ton has been found in the main vein on the 300.

Iris—G. Pray Smith, who formerly operated the Horseshoe mine at Fay, has interested Eastern capital in this property at Deer Lodge. Development is being done.

Horseshoe—A mill test is being made on 1000 tons of tailings by E. E. Fuller.

Juab County

Black Jack—The strike of copper ore recently made on the 1000-ft. level is being drifted on to the south. The ore was cut about 100 ft. south of the Opohongo line. Drifting is also being done in the direction of the latter property. At the monthly meeting the report showed that there was still money on hand, and it was decided not to levy an assessment.

North Iron Blossom—Work was commenced during the week on these claims which adjoin the Beck iron mine in the north end of the district.

Emerald—It is reported that negotiations are being made for the operation of this property via the 2000-ft. level of the Opex.

Eureka-Comstock—This company is being organized to hold a group of 6 claims between Eureka and Homansville. The ground adjoins the North Colorado.

Iron Blossom—A drift is being driven on the 500-ft. level of the No. 3 workings, to get under the cave recently encountered. Exploration has shown silver-lead ore in the bottom of the cave. The 500 is expected to reach the ground in question soon.

Crown Point—The shaft is down 105 ft., which finishes the first contract. Another contract has been given for sinking to the 200-ft. level.

Uncle Sam—The gross value of ore marketed in October is reported to have been over $20,000. For the last two months the company has earned about 3c. a share so that the quarterly-dividend requirements of 2c. a share are being more than met. There are five faces of shipping ore.

Tintic Standard—In a raise from the 700 level, 14 in. of carbonate ore, showing some galena, has been opened. On the same level 450 ft. south of the shaft a fissure showing copper staining is being followed. Two shifts are at work on the 1000-ft. level drifting for the contact of limestone and quartzite.

Yankee—Work is being done on an iron capping, which is thought to be the top of an orebody extending across the Uncle Sam and Beck tunnel. The iron carries gold and silver.

Eagle & Blue Bell—Stations have been completed at the 700 and 800 levels, so that prospecting can be carried on above the orebody, which was developed on the 1000-ft. level. Work will be started here as soon as possible. Timbering of the new shaft is in progress.

Salt Lake County

Utah Leasing—The new cyanide mill of this company at Bingham has been delayed about a month by the nonarrival of a tube mill. This is now on the ground, and work will be started soon. The company has a lease on the Telegraph mine, and has a large tonnage of silicious gold-silver ore blocked, which runs in the neighborhood of $8 per ton.

Eagle Bird—A small streak of ore carrying free gold is reported in the face of the 242-ft. tunnel. The property is in Harker's cañon, on the east side of the Oquirrh range between Bingham and Garfield.

Columbus Consolidated—A report on present mine conditions sent to stockholders, with the notice of assessment No. 4 for 10c. per share, says the assessment was levied for the purpose of paying off part of the present indebtedness, and for carrying on future development. The ore developed is too low-grade to pay actual operating expenses. For the last year the company has barely paid expenses, and has not been able to continue development which should have been done. At present development only will be attempted, until the mine is in shape to start a steady production. Two drifts are being run east of the No. 3 shaft on the 400-ft. level in new territory. This is on the east side of the large Columbus fault, and it is hoped to find a continuation of ore which was opened on the upper levels. The ground is very wet, but there is ample pumping capacity. A strong north and south fissure is being followed. If results are not obtained here drifting east will be started for the contact of the white and black limestone, on which the principal orebodies have made in the property.

Columbus Extension—A new find of 7 ft. of shipping ore is reported in a drift 600 ft. from the face of the main tunnel. A small stringer was drifted on, and opened into ore when the contact of limestone and quartzite was reached. Shipping ore also is being mined in the face of the 4000-ft. tunnel. This tunnel is

being run to get under the Toledo shaft. and will be 1200 ft. deeper than the lowest workings. The Toledo is accredited with a large production in the early days of Alta.

SUMMIT COUNTY

Daly West—The 1900-ft. level is reported to have been in ore 60 ft., and the extent of the body has not been determined. It is said to be a better grade of milling ore than the Daly West average. The drift on the 1550 level, which is being extended toward the Anchor shaft of the Daly-Judge has reached the Daly-Judge line, and arrangements have been made with the Daly West company to continue the work to a point opposite, or beyond the Anchor shaft. Connections will be made by the Daly-Judge by crosscutting to the south on what will be the Daly-Judge 1950-ft. level. The face of the 1550 is in good milling ore on the Daly fissure, and considerable of this ore has been mined in Daly West ground. There is little water at present, but provision has been made to handle a heavy flow at any time. The Ontario drain tunnel is also being extended over to the Daly-Judge line. This will correspond to the 2500-ft. level of the Daly-Judge. During October, the Daly West leasers are reported to have marketed approximately 1000 tons of first-class ore.

West Quincy—A statement giving details of the merger with the Thompson company has been sent to stockholders. This statement says that approximately $180,000 has been expended in attempting to develop the property. The West Quincy company owns five-eighths of 89,308 acres, which will be combined with 46,576 acres owned by Thompson Mining Company. The allotment of Thompson-Quincy stock to West Quincy shareholders will amount to 285,890 shares. The 1200-ft. level of the Daly West will be extended to the lines of the consolidated property for operating purposes.

TOOELE COUNTY

Lion Hill Consolidated—Work of dismantling and razing the old Chloride Point mill is in progress. What material can be used will go into the buildings at the mouth of Buffalo tunnel. Several buildings on Chloride Point ground have already been removed to the Buffalo Consolidated claims. The air line from the Ophir Hill mill has been completed.

Cliff—According to Manager Grant Snyder development has demonstrated the continuity of the ore from the surface to the 1500-ft. level.

Washington

ASOTIN COUNTY

A. A. 1—This company, of Asotin, is planning the installation of machinery on the property on the Grande Ronde river.

Wild Goose—Gold-washing machinery will be installed on this property by James Robinson, Asotin, owner.

FERRY COUNTY

First Thought Extension—Development will be pushed all winter on this property, of which Bert Sharp, Orient, is superintendent. Buildings are being erected.

White Elephant—Buildings are being erected on this property, and machinery will be installed in the spring. It is owned by the Orient Gold Mines Company, Frank Ashley, Orient, president.

Summit—A strike is reported on this property in the Orient district. O. D. Sanford has charge.

KING COUNTY

Lawson—An explosion at this mine, owned by the Pacific Coast Coal Company, Black Diamond, resulted in the death of 15 men and a loss of the property at about $250,000.

OKANOGAN COUNTY

Ben Harrison—Much of work has been planned for this property, and a day and night crew will be operated all winter. It is leased to the Apex Mining Company, and is under the management of George Edington, of Jeffersonville, Indiana.

STEVENS COUNTY

Montezuma—A 20-ton concentrator will be installed. The property is four miles from Chewelah, and owned by Warner Axelton.

West Virginia

BRAXTON COUNTY

Braxton Splint Coal Company—This is one of the largest coal companies chartered in the State for some time. The office is at Gassaway; it will operate near Frametown, and in addition to mining coal, manufacturing coke and building railroads necessary to develop the property, will drill for oil and gas. The authorized capital is $500,000. The incorporators are A. H. Fetzer, of Galion, O., and N. Meiser, D. M. Osborne and others, of Cleveland, O.

Braxton County Coal Company—Organized by New York, Philadelphia and Pittsburg parties to develop 40,000 acres coal land. The plan is to open four drift mines with a daily output of several thousand tons of coal. The organizers are represented by M. P. Kehoe, 502 Law building, Baltimore, Md.

MARSHALL COUNTY

Panama—The miners of this company, of Moundsville, which closed recently, have secured a lease on the mine and will operate it for a while. W. G. Cronkwright, general manager of the plant, stated that a deal with the Wheeling Coal and Coke Company has been on, for the past few weeks, for the 7000 acres of coal owned by the company, and that it will probably be closed in a short time. Later the plant will be purchased, and the whole operated by a new company.

Ben Franklin Coal Company—This company, with M. J. McQuade, of Freeport Penn., as president, will develop its 7000 acres of land recently acquired. The daily capacity of the company is 1000 tons of coal.

Grave Creek Coal and Coke Company—Incorporated with a capital of $500,000. The incorporators are J. Cope, W. C. Black, D. M. Higginbotham, W. Jones and J. Kerr, all of Uniontown, Penn. The company owns 5000 acres of coal land.

Canada

BRITISH COLUMBIA

Hosmer—The daily output of coal from the colliery of the Hosmer Mines, Ltd., in the Crow's Nest Pass, is now about 800 tons. Preparations are being made for increasing production. A coal washery, for cleaning the slack coal before coking, has been completed.

Princeton—A contract has been made to supply the Hedley Gold Mining Company with 10,000 tons of coal from the Princeton colliery, Similkameen, from which production was commenced last year. Plant is being obtained and development work done to bring the daily output up to 500 tons.

Pacific Coast—The Pacific Coast Coal Mines, Ltd., during Nov. made its record production, one day's output having been in excess of 1000 tons. The company's South Wellington mine has only been opened about two years.

Steamboat Mountain—Gold to an average yield of $5 per ton has been found in porphyry dikes in the new mining field named Steamboat Mountain. Heretofore only the higher-grade narrow veins were investigated, but now the porphyry is also receiving attention.

Northern Partnership—This group of gold-quartz claims, in Atlin camp, has been sold for $100,000 to J. M. Ruffner, of Cincinnati, general manager of the North Columbia Gold Mining Company, which has for several years been hydraulicking gold gravels on one of the Atlin creeks. Narrow veins, exceptionally rich, have been found on the group.

Hidden Creek—The Granby company has sent two mining engineers and a number of miners and diamond drill men to this mine to commence development under its bond and option from the Hidden Creek Copper Company. Ore in sight above the lowest adit has been estimated by M. K. Rodgers at more than 300,000 tons.

Queen—Balance of purchase money on the Queen-Yellowstone group and 20-stamp mill, at Sheep Creek, Nelson mining division, has been paid. Amount was $71,428; the transaction was entered into May, 1908; total price was $175,000. The buyers are Wisconsin men. During 12

years gold to the value of between $600,000 and $700,000 has been taken from the Queen and Yellowstone mines.

ONTARIO

Shipments from Cobalt for the week ended Nov. 11 were: Nipissing, 446,620 lb.; Durmmond, 440,000; La Rose, 87,130; Chambers-Ferland, 64,000; Buffalo, 62,530; Temiskaming, 60,000; Colonial, 46,110; Trethewey, 43,870; total, 1,250,260 lb. Bullion shipments: Silver Leaf (Crown Reserve lease), 3728 ounces.

McKinley-Darragh—Returns show that over 2,000,000 oz. have been produced for the first 11 months of 1910. The main shaft is to be continued from the 150- to the 250-ft. level.

Wyandoh—The annual meeting was held at Montreal, Nov. 15. The financial report showed 500,000 shares left in the treasury and about $11,000 cash on hand. The property produced one carload of ore netting $11,683 during the year.

Wettlaufer—An extremely rich oreshoot has been encountered in a winze below the 250-ft. level of this South Lorrain property.

Provincial—Developments of the 175-ft. level have been so satisfactory, that the company has decided to put in a small concentrating plant.

Little Nipissing—The main vein has been cut at the 285-ft. level and shows ore.

Temiskaming & Hudson Bay—A new vein has been struck on the 150-ft. level in drifting toward the Trethewey line. It runs from 2 to 4 in. in width.

Kerr Lake—Several veins of high-grade running from 4 to 6 in. wide have been cut. They are supposed to be continuations of the Crown Reserve veins.

King George—This property in South Lorrain will shortly install a compressor.

Mann-Ryan—The shaft is now down 110 ft. on the Gowganda property. Drifting has been done for 140 ft. on the 85-ft. level on a strong vein showing good silver content. The company has ore stored to the value of $25,000.

ONTARIO-PORCUPINE

It is stated that the six Herlehy-McPharland claims, Tisdale township, Porcupine, have been acquired by a syndicate of New York men. T. D. Nesbitt & Co. have been appointed fiscal agents.

Foster-Ellis—These locations, six in number, in the northern part of Shaw township, have been bought by the Temiskaming & Hudson Bay company, of Cobalt, for $30,000.

Bremner Veteran—This property, lot 9, concession 2, Whitney township, has been purchased by a London banking house identified with South African interests. It will be operated by a company to be incorporated as the Bremner-Porcupine Gold Mines, Ltd.

Mexico

CHIHUAHUA

La Republica—In October the mill treated 1163 tons, from which 73,653 pesos were recovered. The operating expenses were 46,457 pesos. J. Gordon Hardy is consulting engineer. The mine is at La Republica del Sauz, via Ocampo.

DURANGO

Chamole—This mine, at Guanacevi, owned by the Hearst estate, has been leased to Harold Cobb, who is working about 300 men and shipping.

Longega—This group, at Guanacevi, is bieng developed by the Guanacevi Mining and Tunnel Company.

Predicta—This Guanacevi property reports that a new rich orebody has been opened on the 10th level. D. R. Thomas is in charge.

Tecolotes—This and other Guanacevi properties are being operated by Frank Knotts. The cyanide mill is treating 10 tons daily.

West Mexican Mines—J. S. MacArthur has made a favorable report on these properties, at Guadalupe de Calvo, to the English company. He favors the cyanide process for the ore and has recommended a 500-ton plant. He reports over 250,000 tons of $10 ore on the dumps and extensive available ore supplies in the mines.

HIDALGO

La Cruz de Zimapan—This Mexican company, at Barranca de Toliman, is installing pumps and sinking. The property is an *antigua*, extensively operated by an English company in 1824. Miguel Toboada is president.

SONORA

Greene-Cananea—Custom ore bins are being erected near this company's reduction works, with an approximate capacity of 600 tons. The eastern portion of the Cobre Grande zone has been reopened after eight years of idleness, and an electric hoist has been placed at the initial shaft of the old Greene Consolidated. A picking belt, 350 ft. long, will be installed from this shaft to the receiving bins, upon which work is soon to begin. An office building, blacksmith shop and change room is in process of erection at this point. Sixty thousand tons of ore was mined in October and a fraction more than 3,500,000 lb. of bullion produced.

Arizona-Cananea Mining Company—All options held by this company in the Cananea district have been taken up. The claims embrace a wide area of ground with but little development accomplished.

San Geronimo—A 100-ton concentrator has recently been completed at this property, in the Altar district.

Santa Eduviges—Operations have been resumed at this mine, in the Sahuaripa district.

Espiritu Santo—A new corporation is to be formed to take over the assets of this company, and to provide funds for forwarding work. Dr. L. D. Ricketts and other officials of the Greene-Cananea control it.

Mines Company of America—This New York company is carrying on extensive explorations at the Creston Colorado and is building a mill at La Dura mine in the Yaqui river section.

Pacific Smelting and Mining—It is expected to have the Guaymas and Fundicion smelteries in operation in March of 1911. Necessary roasting equipment will be immediately installed at Guaymas plant. Excellent progress has been made in securing contracts for copper and lead ores.

Moctezuma Copper—Two aërial tramways for removing the tailings for storage will be completed before the end of the year. Due to the scarcity of water at the end of the long dry season, this year's production will fall below that of 1909, which was 110,725 tons of concentrates, containing 13,059 tons of copper.

Sonora Copper Smelting—A 500-ton aërial tramway to carry ores from bins at the mouth of the main tunnel to smeltery, 3500 ft., has been ordered. There is a drop of 450 ft. The 100-ton smeltery now being erected will be blown in early in 19111. Plant is being built under a state concession giving exclusive tax exemptions in the Magdalena district of Sonora.

Victoria Mining Company—Erection of a 10-stamp mill at the Esmeralda mine at La Colorado has been started.

Sonora Verde—Philadelphia interests are developing this property, 20 miles east of Imuris. Sinking on a 10-ft. copper-gold vein is in progress.

Industrial Mining Company—Work is being resumed at the property, 35 miles west of Carbo. A tunnel, in 300 ft., will be continued to cut a copper vein 10 ft. wide at outcrop. Prospect shafts have shown values in silver, gold and lead as well as copper.

Mina Mexico—A 75-ton water jacket furnace is being erected at this property in the Sahuaripa district. A freighting outfit has been purchased for hauling between the property and Toledo. W. E. Pomeroy is in charge.

Asia

Oriental Consolidated—This Korean mine in September crushed 27,246 tons and the month's gross receipts were $104,160 and the operating profit $41,376.

South America

PERU

Poto—This hydraulic undertaking near Poto, is higher in the mountains than the Aporoma, and is controlled by an Argentine syndicate; M. Ingolby is manager.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, Nov. 23.—The coal trade in the East continues generally in good shape. The demand for soft coal on the seaboard is good and prices generally are on the advance. There is some trouble about car supply, but not quite as much as in the West. The anthracite trade has been stimulated by a little colder weather and is fairly active.

In the West car supply is still the burning question. There has been some improvement, but the mines everywhere are complaining that it is impossible to fill orders which are pressing, because they cannot ship the coal they produce. The worst trouble is in Illinois, but West Virginia lines are also much behind. A general increase in coal prices is expected soon; it has already taken place in some districts. The demand for coal seems to be good almost everywhere.

Coal Traffic Notes

Coal and coke tonnage originating on all lines of the Pennsylvania Railroad Company east of Pittsburg and Erie, 10 months ended Oct. 31, short tons:

	1909.	1910.	Changes.
Anthracite	9,085,172	9,090,556	I. 5,384
Bituminous	31,710,498	34,050,735	I. 2.340,237
Coke	9,423,903	11,159,102	I. 1,735,199
Total	50,219,573	54,300,393	I. 4,080,820

The total increase this year over 1909 was 8.1 per cent.

Coastwise coal shipments from leading Atlantic ports, nine months ended Sept. 30:

	Anthracite.	Bitum.	Total.	PerCt.
New York	10,513,941	8,327,590	18,841,531	59.8
Philadelphia	1,436,601	3,543,335	4,979,936	15.8
Baltimore	180,272	2,748,927	2,929 199	9.3
Newp't News	.....	2,181,197	2,181,197	6.9
Norfolk	.....	2,595,366	2,595,366	8.2
Total	12,130,814	19,396,415	31,527,229	100.0
Total, 1909.	12,006,228	18,028,930	30,035,158	.....

Total increase this year, 1,492,071 tons, or 5 per cent. New York includes all the harbor shipping points. Norfolk includes Sewalls Point.

Bituminous-coal and coke tonnage of leading railroads in Pennsylvania and West Virginia, nine months ended Sept. 30, short tons.

	Bituminous.	Coke.	Total.
Pennsylvania	30,320.393	10,192,013	40,512,406
Balt. & Ohio	21,277,316	3,369,008	24,646.324
Buff., Roch. & Pitts.	5,430,565	486,798	5,917,363
Buff. & Susqueh'na	1,037,542	208,515	1,246,057
Penn. lines, N. Y. C.	5,719,864	49,107	5,768,971
Pitts. & L. Erie	8 472,121	4,756,343	13,228,464
Pitts. Shawmut & N.	860,873	16,058	876,931
Norfolk & Western.	12,816,117	2,123,518	14,939,635
Ches. & Ohio	11,893,738	343,804	12,237,542
Virginian	949,371	15,462	964,833
Total	98,777,900	21,560,626	120,338,526
Total, 1908	83,767,982	18,164,329	101,932,311

Total increase this year, 18,406,215 tons, or 18.1 per cent. Virginian railway is tidewater tonnage only. Anthracite tonnages of Pennsylvania and Baltimore & Ohio are given elsewhere.

Anthracite tonnage of Baltimore & Ohio railroad, nine months ended Sept. 30, was 562,739 tons in 1909, and 646,333 in 1910; increase, 83,594 tons.

Coal passing Davis Island dam on the Ohio, nine months ended Sept. 30, was 2,366,540 short tons in 1909, and 1,542,-915 in 1910; decrease, 823,625 tons.

Coal shipments over railroads in the Ohio Coal Traffic Association, nine months ended Sept. 30, short tons:

	1909.	1910.	Changes.
Hocking Valley	2,214,870	3,367,089	I.1,152,219
Toledo & Ohio Cent.	958,827	1,564,869	I. 606.042
Baltimore & Ohio	1,090,639	1,783,233	I. 692,594
Wheeling & L. Erie	2,252,717	2,771,902	I. 519,185
Cleve., Lorain & Wh.	1,800,561	2,311,963	I. 511 402
Zanesville & Western	801,530	878,291	I. 76,761
Toledo Div., Pen. Co.	1,319,187	1,664,120	I. 344,933
L. Erie, Alliance & W.	767,810	902,946	I. 135,136
Marietta, Col. & Clev.	56,433	75,474	I. 19,041
Wabash-Pitts. Term.	22,888	45,723	I. 22,835
Total	11,285,462	15,365,610	I.4,080,148

Total increase this year 36.2 per cent. Baltimore & Ohio tonnage is of the Ohio lines only; main-line tonnage is given elsewhere.

New York

Anthracite

Nov. 23—Business is active, as the weather continues cold and domestic consumers are putting in stocks freely. Steam trade is also good.

Schedule prices for domestic sizes are $4.75 for lump, $5 for egg and stove and $5.25 for chestnut, all f.o.b. New York harbor. Chestnut has been advanced 25c., the first advance on the tidewater schedule since 1903. Steam sizes are also higher for the smaller grades. We quote for pea, $3@3.25; buckwheat, $2.25@2.75; No. 2 buckwheat or rice, $1.80@2.25; barley, $1.40@1.75; all according to quality, f.o.b. New York harbor.

Bituminous

The market is strong and coal is in good demand. The shoalwater ports are beginning to hustle after their winter supplies and seem to be taking larger quantities than last year. All-rail and New York harbor trade are good. The West is still calling for coal from mines that usually sell to the seaboard trade, and coal is not over-plentiful.

Prices have advanced all around. Gas coals bring $1.20@1.25 at mines for ¾-in., $1.10@1.15 for run-of-mine and 85c. for slack, the last-named grade being scarce and hard to get. Low-volatile steam coals have advanced 10 or 15c., and bring $2.85@2.90 f.o.b. New York harbor for the lower grades, and up to $3.15@3.25 for the better sorts.

Transportation is poor, and there is a good deal of delay in getting coal to tide. Car supply is poor; on the Baltimore & Ohio mines have been obliged to shut down two or three days a week, because they have no cars. On the Pennsylvania it is a little better, but cars are hard to get.

In the coastwise vessel market rates are higher and still advancing. Current quotations are on a basis of 85@95c. from Philadelphia to Boston and Portland; 70@75c. from New York to points around Cape Cod.

Birmingham

Nov. 21—The production of coal in Alabama is being hampered by the railroad-car situation. There is a shortage of cars. Good prices obtain for coal and there is a demand the like of which has not been experienced in months. The production is as heavy as it has ever been in this State, despite the fact that several of the mines have had to shut down a day or two, having no cars to handle the coal. During the past week there was loud complaint. It was announced that had the railroads been able to handle all the coal that was to come from the mines, there could have been steady operation at practically all places.

There is considerable development again noted in Alabama, new mines being opened in several parts of the district. The prospects are for a steady operation of coal mines for several months to come.

The coke demand is also active and the output is strong. There is a report from two or three places that the car shortage has interfered with the coke make.

Chicago

Nov. 21—Sales of coal remain fairly satisfactory to wholesale and retail interests, the continued cold weather of the last week having stimulated domestic buying, while steam interests showing a disposition to lay in heavier stocks. The fact remains, however, that many retailers are running along with small supplies and decidedly colder weather will make them send up a concerted demand for much more coal to be delivered at once. Against this apprehension the wholesalers set the expectation that in the next 10 days buying of Illinois and Indiana coal will be heavier because of the announced intention of the railroads

to raise freight rates 10c. a ton, which will result in an increase in wholesale and retail prices. Car shortage also is working out object lessons that will increase early buying by prudent consumers.

Illinois and Indiana coals bring $2.40 @3 for lump, $1.90@2.20 for run-of-mine and $1.40@1.75 for screenings, the market being still strong for fine coals. Eastern coals show a generally strong condition, weakness having disappeared in smokeless, which holds up to the list prices of $3.95 for lump and $3.30 for run-of-mine. Hocking is scarce and strong at $3.40, with a steady and increasing demand. Anthracite is active and the scarcity of chestnut has resulted in an advance of 25c. on that size.

Cleveland

Nov. 21—Lake coal shipments are still going on, though the season is near its close. Steam-coal trade is good. Domestic trade is keeping dealers busy and they have been working hard.

Middle-district coal is quoted, f.o.b. Cleveland, at $2.15 for 1¼-in.; $1.90 for ¾-in., $1.80 for run-of-mine, and $1.60 @1.65 for slack. No. 8 and Cambridge district, 5c. higher.

Car supply has shown some improvement, but is not yet up to the mark.

Indianapolis

Nov. 21—Indiana operators have given consumers and the dealers notice that prices will be advanced just as soon as the snow flies. Coal is now selling at the mines at the highest price for several years.

The demand for Indiana block coal is the greatest for years. Usually the price of coal in Chicago and Indianapolis never affects the price at the mines, but now that the operators can get $2.50@2.75 for coal on the cars at the mines and readily sell all they can produce at this rate, they will not attempt to supply local trade at a less figure. The Indiana mines are working at full capacity, the production being slightly retarded for the want of cars; however, the car shortage is not nearly so apparent as it was a week ago.

Pittsburg

Nov. 22—The coal market continues on the quieter basis recently noted, with prices not firm on the reduced basis given last week. Statistics of the coal movement in Western Pennsylvania and Ohio show a movement so far this year as compared with the same period last year from 20 to 30 per cent. larger. The Lake movement is practically over. We quote the open market, subject to some shading, as follows: Mine-run and nut, $1.15; ¾-in., $1.35; 1¼-in., $1.40; slack, 82½@85c. per ton.

Connellsville Coke—John W. Boileau, Park Building, Pittsburg, a dealer in coal lands, has been soliciting Connellsville coke producers to appoint him their sole agent for their unsold output. Mr. Boileau states that he acts on behalf of parties not engaged in the production of coke. This is the tangible effort to bring about the central selling agency which has been discussed in the Connellsville coke trade for a long time. There are about 15,000 ovens in the Connellsville and lower Connellsville region, not controlled by steel and blast furnace interests, but which sell their coke in the market. Of these about 1600 ovens are stated to make inferior coke and to be out of the reckoning. Of the remainder, Mr. Boileau states that he already has the consent of the owners of 8000 ovens to come into the central selling agency plan. In some quarters doubt is expressed whether the plan would be legal, in view of the Imperial Window Glass Company case, decided in Pittsburg only a fortnight ago, the company pleading *nolo contendere* to the government suit and winding up its affairs. The window glass company was a sales agency for window-glass producers, but on behalf of the coke-selling agency it is stated the latter will be different because the stock of the window-glass company was held by the producers, while the coke-selling agency's profits will not go to the coke producers. From these and other causes the coke market has been very quiet. A Wheeling steel and iron interest has made a requirement contract with a Pittsburg brokerage firm for its coke requirements for a period of two years beginning Jan. 1 next, involving about 30,000 tons monthly. It is understood the deal was made a fortnight ago, but information has just been obtained by the trade. The reported basis is a ratio of 8 to 1 on basic iron; that is, if basic pig iron is $14, Valley, the coke is billed at $1.75 at ovens, and so on. We quote prices, unchanged but largely nominal, as follows: Prompt furnace, $1.40@1.50; contract, $1.75@1.85; prompt foundry, $2@2.10; contract foundry, $2.25@2.50, all per ton at ovens.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ending Nov. 12 at 327,860 tons, a drop of 13,000 tons, and shipments at 3323 cars to Pittsburg, 5512 cars to points west and 572 cars to points east, a total of 9407 cars.

St. Louis

Nov. 21—The weather has been very brisk this week and consequently there has been a little quickening in the demand for coal, though prices on the whole remain very much the same. Dealers are still busy though they are not as rushed as they were and are in a position now to make prompt delivery. This is, of course, an entirely normal condition at this time of the year. The country trade is taking a good share of coal and prices prevailing in the country are a great deal better than locally, largely owing to the car restrictions.

The car situation is, if anything, a little worse than at any time this year. Every road running into East St. Louis is extremely short. The Louisville & Nashville, and the Baltimore & Ohio, particularly, are feeling the car shortage heavily, as these roads have not over a 50 per cent. supply, whereas, generally, they have all the cars they can use. The Missouri Pacific is not feeling a serious car shortage but is handling coal very slowly and has become blockaded at a number of reconsigning points. The reason for this is the strike of their machinists and boilermakers.

The main feature of the market this week has been the sharp rise in the price of fine coal. Screenings have advanced to 30@35c. per ton locally and Chicago is absorbing all that will go that way on a 90c. rate at 50@60c., at mine. Steam nut is also in better demand and has advanced 15c. per ton.

Current prices in the St. Louis market are as follows:

Standard:	F.o.b. Mine.	F.o.b. St. Louis.
6-in. lump	1.40	1.92
2-in. lump	1.20	1.72
Mine-run	0.95	1.47
2-nut	0.80	1.32
2-in. screenings	0.30	0.82
Pea and slack	0.10	0.62
Staunton, Mt. Olive & Springfield:		
6-in. lump	2.00	2.52
3-in. lump	1.75	2.27
Mine-run	1.40	1.92
2-in. nut	1.00	1.52
2-in. screenings	0.50	1.02
Carterville:		
6-in. lump or egg	2.00	2.67
3-in. nut	1.75	2.42
Mine-run	1.20	1.87
1½-in. screenings	0.75	1.42
Franklin County:		
6-in. lump or egg	2.00	2.67
3-in. nut	1.75	2.42
2-in. nut	1.50	2.17
1½-in. screenings	0.75	1.42
Trenton:		
6-in. lump	2.50	3.02
6-in. egg	2.50	3.02
3-in. nut	2.00	2.52
Pennsylvania Anthracite:		
Chestnut	....	7.20
Stove and egg	....	6.95
Grate	....	6.70
Arkansas Anthracite:		
Egg or grate	4.00	6.00
Coke:		
Connellsville foundry	2.50	5.30
Gas house	....	5.00
Smithing coal	1.65	4.15
Pocahontas Smokeless:		
Lump and egg	2.25	4.75
Mine-run	1.25	3.75

Prices at East St. Louis are 20c. per ton below the St. Louis quotations.

FOREIGN·COAL·TRADE

Alberta Coal—The official statement of coal production in the Province of Alberta, Canada, in the year 1909, is as follows: Anthracite, 213,257; bituminous, 1,197,399; lignite, 763,673; total, 2,174,329 tons, an increase of 329,329 tons over 1908. Coke produced was 87,812 tons; coal used in making coke, 148,104 tons, or 1.69 tons to the ton of coke. There were 89,785 tons of briquets made.

IRON·TRADE·REVIEW

New York, Nov. 23—The iron and steel trades generally seem to be making little progress just now. While there is a better demand for raw iron, finished material is still rather slow. Expectations of November improvement have been disappointed, and it is to be remembered that December is proverbially a dull month in the trade.

Pig iron is the strongest point in the market. There have been better sales of foundry iron in the East, and basic pig is active in the Central West. The furnacemen accordingly are firmer in their views, and are inclined to hold prices, though there is little talk of any advance.

In finished material small trade is fair, especially in pipes and bars. Sheets are in smaller demand and prices are being shaded to secure orders. Structural steel has been rather slow, though small orders keep on coming. The railroads have not come forward as it was said that they were about to do. Orders for about 45,000 tons of rails are noted, but none of the larger companies seem disposed to place their contracts yet. Equipment orders are light, and only a few roads are placing orders. New business on the whole has been rather light, and specifications on contracts are coming in more slowly than they were. However, the jobbing trade in small materials is reported to be good.

Birmingham

Nov. 21—While a number of small orders for iron have been booked, some for delivery during the remaining 40 days in this year and some for the first three months of the coming year, it is not believed that the buying movement has started in yet. A number of inquiries are in hand and prices have been made. The belief is firm that the buying will start in before the holiday season comes on. The aggregate of the business is not great but a better feeling prevails. Prices have taken on some strength and there is positively no iron to be had now at $11 per ton. The minimum price, as far as can be learned is $11.25 per ton, No. 2 foundry basis, though $11.50 is being asked for iron to be delivered during the first quarter of 1911.

The make in Southern territory is holding up fairly well, but there will be no improvement in the production during the balance of the year.

There is a slight improvement in the steel line. The demand for steel bars, plates and other products of a similar nature is somewhat better than it has been in some time. There has been a steady production at the steel plants.

Charcoal iron is not in active demand. The scrap-iron market is very quiet.

The accumulated stocks of pig iron in the Birmingham district are estimated to be under 200,000 tons. There was no iron sent to the yards during the past week.

Chicago

Nov. 21—The pig-iron market has developed strength in the last week, as a result of more general buying of foundry iron for first-half delivery that has followed some large purchases, chiefly of Northern iron. There is still considerable trading in small lots for early delivery; but the average melter is becoming more and more willing to contract for his needs of six to eight months ahead, a condition that means strength for the furnaces. Southern No. 2 iron for first-half delivery is strong at $11.50 Birmingham ($15.85 Chicago) for small lots, but the larger contracts are made at nearly if not quite $11 Birmingham, and any good-sized purchase can doubtless be made at that figure. Northern No. 2 iron sells at about $16.50, this price being obtained on most sales for the first half. An indication of strength appears in the increased number of inquiries for second-quarter delivery from melters who have been heretofore considering only first-quarter delivery; the tendency indeed is general to contract for the whole six months.

The market for iron and steel products is improving; nearly all lines show more sales and the tone of the selling interests is one of renewed confidence. Coke shows a firmer tendency with none too much on hand and the best Connellsville selling at $4.90, Chicago.

Cleveland

Nov. 21—Bad weather on the Lakes has still further limited the movement of iron ore.

Pig Iron—The local market is quiet, but business outside is more active, both in the way of inquiries and sales. For Cleveland delivery prices continue $15.90 for bessemer; $14.25@14.50 for basic; $14.25 for No. 2 foundry; $18 for Lake Superior charcoal.

Finished Material—There is some improvement in demand for bars and sheets. Some small contracts for structural steel have been let. There is a special demand just now for reinforcing bars for concrete structures. Specifications on contracts are coming in more freely.

Philadelphia

Nov. 23—There has been a small-sized scramble during the past few days on the part of local, near-by and a few New England buyers for small lots of pig iron in which foundry chiefly figured. This was due to some unexpected shadings made, coupled with a report of activity in some other markets. Today's reports indicate further activity among the smaller buyers particularly, although all the larger local consumers have placed contracts amounting to several thousand tons. As to the continuance of this activity, furnace agents differ in opinion but believe that the low condition of stocks and the stronger probability of improving prices will induce quite a number of those who have been making inquiries for a few weeks past to fall in line as buyers. Basic pig is also moving in larger lots. The quotations are $16 for No. 2 X foundry and $15 for certain grades of Southern. Gray forge has sold at $14.50, at which also best grades of Southern forge are held.

Steel Billets—The policy of buyers of billets is to allow the weakening influences to exert their full force before showing any sign of buying in a large way.

Bars—Bars are sluggish and even store demand in city and country is reported less than at any time during the autumn. Some mills are restricting production but have made themselves safe with an abundant assortment.

Structural Material—Orders are provokingly small and slow.

Scrap—Not a single sale has been made to indicate the condition of the scrap market.

Pittsburg

Nov. 22—The iron and steel market has grown even more quiet than it was immediately after the election, and prices show a fresh weakening tendency, although only in certain branches. There is no hope of any increase in business this year and as old orders play out, continually decreasing production is expected. The Carnegie Steel Company has again cut its retail prices on structural shapes, from warehouse.

Plain wire and wire nails are being shaded on occasion by $1 a ton, but the cut prices are not being made in all districts. The nominal prices have been 1.50c. on plain wire and $1.75 on wire nails.

No official information can be obtained today as to when the Pittsburg Steel Company will begin building the two 400-ton furnaces which are to result from its new financing, and which will take it out of the market as a buyer of basic pig iron. The company gets $1,000,000 cash through the sale of $1,000,000 common stock to the holders of the present $6,000,000 issue, while it makes a new issue of $7,000,000 in 7 per cent. cumulative preferred stock to Speyer & Co., who undertake to obtain and turn in the present bonds outstanding. These are bing bought at 110 for $3,250,000 remaining of a $4,000,000 issue in 1907, and 102½ for $500,000 remaining of an issue of $1,000,000 in 1908, both being 6 per cent. bonds, while the preferred stock is offered at 99 in exchange. Thus it will require about $4,150,000 preferred stock to cover the bonds, the difference between this and the $7,000,000 covering Speyer & Co.'s profit and such cash as it may pay into the treasury, the amount not being stated.

Pig Iron—In some quarters heavier inquiries are noted, but the market is entirely lacking in snap and the inquiries coming out are evidently merely forced by the fact that consumers have bought very sparingly for many months, during which time they were using up iron on their old contracts. The American Steel Foundries has closed the 10,000 tons of basic iron for its Alliance, Ohio, plant, mentioned as an inquiry in last report, for the first four months of next year, and the price is understood to have been somewhat below $13.50, Valley. The market price of basic iron remains an unsettled question, except that it is pretty well developed that the asking prices of $13.50 and $13.75, Valley, for early delivery are higher than could be done on a firm offer. We quote the market as follows at Valley furnaces, 90c. higher delivered Pittsburg: Bessemer, $15; basic, $13.25; No. 2 foundry, $13.75@14; malleable, $13.25@13.50 per ton.

Ferromanganese—The market continues quiet and weak, prices being largely nominal at $38.50 for prompt and $38.75 for forward, at Baltimore, freight to Pittsburg being $1.95 per ton.

Steel—The mills have come to quote more strictly on a Pittsburg basis, endeavoring to eliminate the quoting of the regular base price at various mills, whereby the markets had been whipsawed into a rather irregular position. This has served to stiffen bessemer steel slightly, but open-hearth is weaker, having been decidedly on the down grade lately. Bessemer sheet bars are the strongest commodity, the Carnegie price being $25, Pittsburg, plus full freight to destination. We note a sale by another interest of 2000 tons, for near-by delivery, at $24.40, Pittsburg, or $25.40, delivered, the delivery point taking $1 freight from Pittsburg. Open-hearth sheet bars can hardly be done at the low price obtaining in the sale reported last week, which was $23, Pittsburg, or $24, delivered Wheeling. We quote, Pittsburg, plus freight to destination: Bessemer billets, $23; sheet bars, $24.50; open-hearth billets, $23.50@24; open-hearth sheet bars, $23.50@24; rods, $28.50.

Sheets—The flow of business to the mills has grown somewhat thinner, and prices are fully as irregular as formerly. Some mills, being comfortably sold up, are adhering to 2.20c. on black, 1.65c. on blue annealed, 3.20c. on galvanized, $1.60 on painted corrugated and $2.80 on galvanized corrugated, but mills in need of business are shading these prices at least $1 a ton.

St. Louis

Nov. 21—The pig-iron market this week has shown quite a little life. Business for first-quarter delivery has been coming in freely, though prices remain unchanged. The sale of spot iron was a little better than last week and a number of small orders for immediate delivery have been received. The prevailing price is $1.50 per ton, f.o.b. Birmingham, or $15.25, St. Louis, for No. 2 foundry.

Sault Ste. Marie Canal

The total freight passing through the Sault Ste. Marie canals for the season to Nov. 1 was, in short tons:

	1909.	1910.	Changes.
East-bound	38,606,780	43,288,425	I. 4,681,645
West-bound	9,559,908	13,417,542	I. 3,857,634
Total	48,166,688	56,705,967	I. 8,539,279

The total number of vessel passages this year was 18,825, giving an average cargo of 3014 tons. The mineral freights included above were as follows, in short tons, except salt, which is in barrels:

	1909.	1910.	Changes.
Coal	8,316,830	11,960,386	I. 3,643,556
Iron ore	34,410,953	39,009,985	I. 4,599,032
Pig and mfd. iron.	407,594	515,257	I. 107,663
Copper	94,230	115,373	I. 21,143
Building stone	1,674	9,485	I. 7,811
Salt, bbl.	531,065	483,529	D. 47,536

Iron ore was 68.8 per cent. of the total freight this year, and coal 21.1 per cent.

FOREIGN IRON TRADE

Swedish Iron and Steel—Production in Sweden for the half year ended June 30 is reported as follows, in metric tons:

	1909.	1910.	Changes.
Pig iron	285,900	306,100	I. 20,200
Puddled blooms	61,200	72,900	I. 11,700
Converter steel ingots	40,900	52,400	I. 11,500
Open-hearth ingots.	158,100	179,200	I. 21,100

Exports for the half-year in 1910 included 48,200 tons pig iron, 3600 tons scrap, 18,900 tons steel in various forms and 117,100 tons puddled blooms, billets, wirerods and bars.

METAL MARKETS

New York, Nov. 23—The metal markets generally show some activity, but no material changes from the recent reports.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Oct. 1910..	$ 750,330	$ 4,247,259	Imp.$ 3,496,929
" 1909..	9,379,402	7,034,164	Exp. 2,345,238
Year 1910..	56,068,411	49,929,386	" 6,139,025
" 1909..	106,652,236	38,139,557	" 68,512,679
Silver:			
Oct. 1910..	4,269,575	3,395,200	Exp. 874,375
" 1909..	4,053,745	4,048,669	" 5,076
Year 1910..	46,034,318	36,652,464	" 9,381,854
" 1909..	47,342,861	37,289,199	" 10,053,662

Exports from the port of New York, week ended Nov. 19: Gold, none; silver, $1,250,317, chiefly to London. Imports: Gold, $126,921; silver, $88,985, from Japan, Australia and South America.

Gold—The price of gold on the open market in London continued at 77s. 9d. per oz. for bars, but a shade lower—76s. 4½d. per oz.—was quoted for American coin. The Bank of England took most of the supplies arriving.

Platinum—Business continues good and the market is strong. Prices are unchanged. Dealers ask $39.50@39.75 per oz. for refined platinum, and $43@44 for hard metal.

Our Russian correspondent writes, under date of Nov. 10, that there has been again an advance in prices. The demand from abroad is heavy, and the larger dealers and producers are holding back, expecting a farther advace. Crude metal, 83 per cent. platinum, is quoted at Ekaterinburg 8.50 rubles per zolotnik—$31.96 per oz.; at St. Petersburg, 32,600@32,800 rubles per pood—$32.05 per oz., average. The new regulations for the platinum industry have been approved by the Council of Ministers and will be in a short time introduced in the Duma.

Silver—This metal has been very steady with only small fluctuations; closing at 25 9/16d. in London.

SILVER AND STERLING EXCHANGE

Nov.	17	18	19	21	22	23
New York	55⅛	55⅛	55⅛	55⅛	55⅛	55⅛
London	25 5/8	25 5/8	25 5/8	25 5/8	25 5/8	25 5/8
Sterling Ex.	4.8600	4.8585	4.8600	4.8590	4.8580	4.8600

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, Jan. 1 to Nov. 10:

	1909.	1910.	Changes.
India	£5,351,000	£6,085,000	I. £ 734,000
China	1,829,300	1,143,500	D. 685,800
Straits	82,800	.....	D. 82,800
Total	£7,263,100	£7,228,500	D. £ 34,600

India Council bills in London brought an average of 16.09d. per rupee for the week.

The China loan for £10,000,000, which has as its avowed object the reform of the currency, has now been definitely concluded.

Foreign trade of the United States, 10 months ended Oct. 31, as reported by the Bureau of Statictics, Department of Commerce and Labor:

Merchandise:	1909.	1910.
Exports	$1,361,722,253	$1,430,984,543
Imports	1,196,267,707	1,296,226,777
Excess, exports	$ 165,454,546	$ 134,757,766
Add excess of exports, silver		9 381,854
Add excess of exports, gold		6,139,025
Total export balance		$ 150,278,64

The movement of gold and silver in detail will be found in the table at the head of this column.

James E. Pope has been chosen president of the New York Metal Exchange in place of Paul Koning, who recently resigned on account of his removal from New York to Germany.

Copper, Tin, Lead and Zinc

NEW YORK

Nov.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. New York, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
17	12⅞ @13	12.70 @12.80	36½	4.40	4.25 @4.30	5.97½ @6.02½	5.82½ @5.87½
18	12⅞ @13	12.70 @12.80	36¼	4.50	4.35 @4.40	5.97½ @6.02½	5.82½ @5.87½
19	12⅞ @13	12.70 @12.80	36¼	4.50	4.35 @4.40	5 97½ @6.02½	5.82½ @5.87½
21	12⅞ @13	12.70 @12.80	36⅞	4.50	4.35 @4.40	5.97½ @6.02½	5.82½ @5.87½
22	12⅞ @13	12.70 @12.80	36⅞	4.50	4.35 @4.40	6 00 @6.02½	5.85 @5.87½
23	12⅞ @13	12.70 @12 80	36⅞	4.50	4.35 @4.40	6 00 @6.02½	5.85 @5.87½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Nov.	Copper. Spot.	Copper. 3 Mos	Copper. Best Sel'td	Tin. Spot.	Tin. 3 Mos	Lead, Spanish.	Zinc, Ordinaries.
17	57⅝	58 9/16	62	166½	166⅝	13 5/16	24⅛
18	57⅝	58 9/16	62	166	166	13 3/16	24⅛
19	.....	.....	.....	.....	.....	.....	.....
21	57⅞	58 11/16	62	167⅞	167⅞	13 5/16	24⅛
22	57 13/16	58¾	62	167½	167½	13⅜	24⅛
23	57⅝	58 9/16	62	167¾	167¾	13 5/16	24⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months ,and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market has been dull throughout the week. Buyers, both here and abroad, having lately supplied their wants liberally, are awaiting developments, and such business as offered itself was taken at slight concessions from recent prices. The close is steady at 12⅞ @13c. for Lake copper, and 12.70@ 12.80c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12½@12⅝ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 14¼c. base, carload lots at mill.

Speculation has been on a much smaller scale, and as a result fluctuations in the standard market moved within narrow limits. The close is cabled at £57 12s. 6d. for spot, and £58 11s. 3d. for three months.

Exports of copper from New York for the week were 10,306 long tons. Our special correspondent reports exports from Baltimore for the week at 1076 tons.

Tin—The London market remained firm all through the week, and contrary to all expectations no effort has so far been made to depress the market incidental to the Banka sale, which takes place Nov. 24. Domestic consumers, who were buyers the middle of last week, have again stopped their purchases. While spot material is firmly held, offers of futures are made below the import basis, without, however, leading to business. The market closes strong at £167 15s. for both spot and futures in London, and about 36⅞c. in New York.

Lead—A little more life was infused into the market due to the advance of $2 per ton in the price of the leading sellers. The trade was taken unawares, and no orders having been placed in anticipation of higher prices, a good business developed at the new level, the close being firm at 4.50c. New York, and 4.35@4.40c. St. Louis.

It is reported from abroad that business in lead has been on a very much heavier scale, due to the excellent consumption from all sources. The close is firm at £13 3s. 9d. for Spanish lead, and £13 6s. 3d. for English lead. Some uneasiness is felt as to the influence which the disturbances in Mexico may have on shipments from that country.

The American Smelting and Refinng Company on Nov. 18 advanced its price for desilverized lead to 4.50c., New York.

Spelter—The market has been rather dull throughout the week, and lower prices have been quoted on such small business as offered itself from day to day. A little better tone developed at the close, which is steady at 5.85@ 5.87½c. St. Louis, and 6@6.02½c. New York.

The London market is unchanged at £24 2s. 6d. for good ordinaries, and £24 7s. 6d. for specials.

Base price of zinc sheets is $7.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—The interest in this metal has petered out and it is again offered freely at 23c., with the indication that business can be consummated at a concession. We quote 22½@23c. for No. 1 ingots.

Antimony—Business continues quiet. Prices have been generally reduced. Cookson's is now quoted at 7¾@7⅞c. per lb.; while 7½@7¾c. is asked for U S., and 7⅛@7¼c. for outside brands.

Quicksilver—Sales are reported good. New York quotations are $43.50 per flask of 75 lb. for large lots; $45.50@46.50 for jobbing orders. San Francisco, $43 for domestic orders and $2 less for export. The London price is £8 per flask, with £7 15s. quoted by second hands.

Cadmium—Current quotations are 60 @70c. per lb. in 100-lb. lots, f.o.b. New York, according to quantity of metal.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The high price of electrolytic is 5c. higher.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, ten months ended Sept. 30, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.	
Copper, long tons	106,888	69,028	Imp.	37,860
Copper, 1909....	142,985	52,103	Imp.	90,882
Tin, long tons....	37,266	36,203	Imp.	1,063
Tin, 1909.....	35,250	35,046	Imp.	204
Lead, long tons..	184,925	40,480	Imp.	144,445
Lead, 1909	170,730	38,630	Imp.	132,100
Spelter, l'g tons..	110,835	7,530	Imp.	103,305
Spelter, 1909....	94,213	6,615	Imp.	87,598
Quicksilver, lb...	3,279,649	1,495,022	Imp.	1,784,637
Quicksilver, '09	3,108,571	1,178,137	Imp.	1,930,434
Ores:				
Tin ore and con.	21,825	.....	Imp.	21,825
Tin ore, 1909...	19,547	.....	Imp.	19,547
Pyrites	669,288	.....	Imp.	669,288
Pyrites, 1909...	651,272	.....	Imp.	651,272

Copper totals include metallic contents of ore and matte. Exports include reexports of foreign material. Of the imports in 1910, the United States furnished in all 396 tons copper matte, 30,796 tons fine copper, and 28,391 tons lead. This lead was chiefly Mexican, refined in this country.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 19—The highest price paid this week for zinc ore was $47; the base price, 60 per cent. zinc, was $46@47. The base price paid for 80 per cent. lead ore was $52 per ton.

SHIPMENTS, WEEK ENDED NOV. 19.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.....	1,470,660	.....	.....
Platteville.....	1,198,460	.....	432,200
Galena.....	679,651	.....	.....
Highland.....	520,300	80,700	.....
Benton.....	424,100	.....	.....
Harker	325,200	.....	.....
Cuba City.....	245,535	64,970	.....
Linden.....	.....	52,600	60,590
Total.....	4,863,906	198,270	492,790
Year to date.....	104,058,085	9,008,324	23,813,950

Shipped to separating plants, this week, 3,001,200 lb. zinc ore.

Joplin, Mo., Nov. 19—The highest price paid for zinc sulphide ore this week was $51, on a base price of $48 per ton of 60 per cent. zinc. Zinc silicate ore

sold on a base price of $23@26 per ton of 40 per cent. zinc. The average price, all grades of zinc ore was $43.78. The highest price paid for lead ore this week was $56 per ton, and the average price, all grades, was $55.64 per ton.

The zinc market was stronger again this week, the base price advancing to, $48; two choice bins of ore in the Webb City camp being sold at that figure. Most of the ore sold this week was on a $46 to $47.50 base.

The lead market was also stronger, $56 being paid pretty generally all over the district. The lead smelter, at Galena, Kansas, burned last Sunday morning, causing a loss of $15,000, and their buyer was in the field very lightly this week.

SHIPMENTS, WEEK ENDED NOV. 19.

	Zinc lb.	Lead lb.	Value.
Webb City-Carterville	3,985,520	540,370	$106,806
Joplin	2,530,920	255,640	66,632
Oronogo	743,050	173,560	21,834
Alba-Neck	754,050	.....	18,851
Galena	564,680	37,600	13,720
Duenweg	623,630	5,460	13,617
Jackson	452,340	9,820	10,423
Granby	561,320	23,040	9,710
Aurora	342,660	54,940	7,361
Miami	332,130	.....	4,981
Spurgeon	398,480	6,710	4,960
Sarcoxie	252,330	.....	4,129
Badger	160,500	.....	3,611
Carl Junction	129,240	.....	3,380
Carthage	125,770	.....	2,892
Cave Springs	50,910	.....	1,145
Wentworth	31,000	.....	310
Totals	12,038,530	1,107,140	$294,362
47 weeks	530,090,130	74,877,690	$12,469,823

Zinc value, the week, $263,547; 47 weeks, $10,526,072
Lead value, the week, 30,815; 47 weeks, 1,943,751

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	40.20	40.35	37.83	57.52	48.80
July	43.06	39.63	41.11	36.80	53.74	48.59
August	48.25	40.13	44.54	37.32	57.60	49.75
September	47.70	43.45	44.87	39.96	56.11	54.73
October	49.50	43.31	45.75	40.50	55.02	53.18
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
Year	$43.98	.....	$41.20	.....	$54.60	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

New Caledonia Ore Exports

Exports of nickel ore from New Caledonia for the eight months ended Aug. 31 were 55,858 metric tons. Exports of chrome ore were 25,481 tons.

CHEMICALS

New York, Nov. 19—The general market remains rather quiet, but some tendency to improvement is reported.

The International Agricultural Corporation has added five new members to the board of directors, all representatives of the banking houses which financed the latest addition of capital. The new members are T. W. Lamont, Albert H. Wiggin, Benjamin Strong, Jr., Charles H. Sabin and Francis M. Weld, all of New York.

Copper Sulphate—Business has been quite active. Prices are unchanged, at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller parcels.

Arsenic—The market is dull again, and quotations are at a low point, $2.25 per 100 lb. being quoted for white arsenic.

Nitrate of Soda—The market is rather quiet. Prices are unchanged, at 2.12½c. per lb. for both spot and futures.

Potash Salts—A recent consular report calls attention to the Austrian deposits of potash salts at Kalusz, Galicia, where development is being actively carried on, and the possibility of a large supply has been shown. The Austrian government has authorized the syndicate working the deposits to sell any surplus over home requirements which may be mined, at competitive prices.

Exports of potash salts from Germany for the nine months ended Sept. 30 were, in metric tons:

	1909.	1910.	Changes.
Kainit, etc.	512,396	812,416	I. 300,020
Potassium chloride	142,023	190,356	I. 48,333
Potassium sulphate	40,901	51,916	I. 11,015
Pot.-magnesium sul.	91,111	138,632	I. 47,521
Total	786,431	1,193,320	I. 406,889

Of the exports this year 704,110 tons, or 59 per cent. of the total, went to the United States.

MINING·STOCKS $

New York, Nov. 23—The stock markets generally have shown a little more strength in some specialties, but no general advances. Trading continues chiefly professional, and the public does not seem to be concerning itself to any great extent.

The Curb market has been active in spots, and rather irregular. Copper stocks have held up well and have been in fair demand. Cobalt stocks have done about as well as any section of the market, and hold their prices. The Nevada stocks do not show much volume of business.

Auction sales of mining stocks in New York, Nov. 17, included 5000 shares Sun & Moon Mining and Milling Company, $105 for the lot; 40,000 shares Ohio Copper, $10 par, 12½c. per share; 28,128 shares United Copper common, $4.87½; 18,700 shares Davis-Daly, second assessment unpaid, 82c. per share.

Boston, Nov. 21—Copper shares continue firm in tone, but lack animation except in spots. A $42 advance in the price of Calumet & Hecla shares to a high at $602 has brought out rumors to the effect that a consolidation of its various subsidiaries was to be effected preliminary to a general consolidation of the leading Lake Superior mines. Calumet officials deny all knowledge of it, but the advance from a low at $525 early in the year is considered significant.

East Butte continues the most active feature of the market and after a period of profit-taking from its recent high, the price is now recovering. Lake Copper has been quiet and inclined to be heavy.

Practically all of the Lake Copper stock

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company.	August.	September.	October.
Anaconda	.....	22,200,000	22,100,000
Arizona, Ltd.	2,620,000	2,672,000	3,004,000
Balaklala	.....	*nil*	928,360
Boleo (Mexico)	2,039,520	2,061,300	2,278,454
Copper Queen	7,796,559	6,903,759	7,060,796
Calumet & Ariz.	2,560,000	2,535,000	1,990,000
Cananea (Mexico)	3,526,000	3,565,000	3,576,000
Detroit	2,100,000	2,128,000	1,757,836
East Butte	.....	625,840	948,369
Imperial	400,000	*nil*	*nil*
Mammoth	.....	.....	.....
Moctezuma (Mex.)	1,630,204	2,211,435	1,791,108
Nevada Con.	6,052,621	5,151,208	5,250,000
Old Dominion	2,693,000	2,262,000	2,345,000
Shannon	1,546,000	1,418,000	1,286,000
Superior & Pitts.	2,520,000	2,125,000	2,095,000
Utah Copper Co.	7,440,035	7,077,035	.....
Butte District	23,750,000	.....	.....
Lake Superior	18,800,000	16,700,000	18,500,000
Total production.	85,473,949	79,628,571	.....
Imports, bars, etc.	13,324,788	24,303,859	.....
Total blister	98,798,727	103,932,430	.....
Deduct Can. & Moc.	5,156,204	5,776,435	.....
Net blister rep.	93,642,523	98,155,995	.....
Imp. in ore & matte	13,031,254	5,782,067	.....
Total	106,673,777	103,938,062	.....

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and Moctezuma. Boleo copper does not come to American refiners. Utah Copper report includes the output of the Boston mill. Butte district production from September is given under Anaconda and East Butte.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
XI, 1909	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910	116,547,287	78,158,387	81,691,672
II	112,712,493	66,618,322	37,369,518
III	120,067,467	62,944,818	40,585,767
IV	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912

VISIBLE STOCKS.

	United States.	Europe.	Total.
XI, 1909	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910	141,766,111	244,204,800	385,970,911
II	98,463,339	248,236,800	346,700,139
III	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,817
VIII	170,640,678	222,320,000	392,960,678
IX	168,881,245	218,444,800	387,326,045
X	148,793,714	211,276,800	360,070,514
XI	139,261,914	198,060,800	337,322,714

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

recently offered to stockholders at $35 per share was taken by them and the remaining 1086 shares of treasury stock will be sold at public auction, Nov. 30, in accordance with a custom of Massachusetts corporations. This will remove any criticism that the underwriters took advantage of their position to get cheap stock. The entire 100,000-share issue will then be subject to future assessment calls of $22 per share.

Rhode Island Coal has been the Curb feature, with an advance to above $10 per share. Pennsylvania coal interests have taken an interest in this property and the company has decided to offer 20,000 shares of treasury stock at $10 per share. United Verde Extension has been listed on the Curb, and is up to $3.37½. Both Calaveras and Tuolumne have shown material advances.

Assessments

Company.	Delinq.	Sale.	Amt.
Amador C. & G., Ida	Dec. 15	Jan. 15	$0.01
Bonanza Mt. Copper, Ida	Nov. 18	Dec. 17	0.001
Caledonia, Nev	Dec. 9	.....	0.10
Cedar Creek, Ida	Nov. 14	Dec. 14	0.004
Chollar, Nev	Dec. 5	Dec. 30	0.10
Columbus Con., Utah	Nov. 26	.....	0.10
Gold Mt. Champion, Utah	Dec. 1	Dec. 19	0.00½
Gould & Curry, Nev	.....	Dec. 27	0.10
Gray Copper, Ida	Nov. 5	Dec. 10	0.001
Horseshoe, Ida	Dec. 10	Jan. 10	0.002
Hypotheek, Ida	Nov. 15	Dec. 8	0.007
Ida. Belcher M. & M., Ida	Nov. 15	Dec. 10	0.002*
Ida. Copper M. Ltd., Ida	Nov. 22	Dec. 22	0.003
Iron Mask, Ida	Nov. 18	Dec. 8	0.002
Keystone, Utah	Dec. 15	.....	0.05
Little North Fork, Ida	Nov. 15	Dec. 31	0.004
Lucky Swede G. & C., Ida	Dec. 1	Dec. 31	0.001
Mex. Con. M. & M	Nov. 15	Dec. 15	1.00
Mineral Farm, Ida	Nov. 12	Dec. 17	0.003
North Star, Ida	Nov. 28	Dec. 20	0.001
Reindeer C. & G., Ida	Oct. 15	Dec. 1	0.005
Silver Queen, Utah	Dec. 15	Jan. 10	0 004
Trans.-Cont. S. & C., Ida	Nov. 24	Dec. 15	0.002

*One-half mill.

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538	53.462	24.166	24.651
July	51.043	54.150	23.519	25.034
August	51.125	52.912	23.588	24.428
September	51.440	53.295	23.743	24.567
October	50 923	55.490	23.502	25.596
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.706	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

	New York.				London.	
	Electrolytic		Lake.			
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.56½	12.733	12.93⅞	13.091	57.363	57.238
May	12.893	12.550	13.238	12.885	59.338	56.313
June	13.214	12.404	13.548	12.798	59.627	55.310
July	12.880	12.215	13.363	12.570	58.556	54.194
August	13.007	12.490	13.296	12.715	59.393	55.733
September	12.870	12.379	13.210	12.668	59.021	55.207
October	12.700	12.553	13.030	12.788	57.551	56.722
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28.060	32.700	July	29.125	32.695
February	28.290	32.920	August	29.966	33.972
March	28.727	32.403	September	30.293	34.982
April	29.445	32.976	October	30.475	36.190
May	29.225	33.125	November	30.859	.....
June	29.322	32.769	December	32.913	.....
			Av Year	29.725	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4.307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350	4.343	4.291	4.207	13.031	12.688
July	4.321	4.404	4.188	4.291	12.563	12.531
August	4.363	4.400	4.227	4.290	12.475	12.513
September	4.342	4.400	4.215	4.289	12.781	12.582
October	4.341	4.400	4.215	4.271	13.175	13.091
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402	5.128	5.252	4.978	22.000	22.094
July	5.402	5.152	5.252	5.002	21.969	22.406
August	5.729	5.279	5.579	5.129	22.125	22.800
September	5.796	5.514	5.646	5.364	22.906	23.165
October	6.199	5.628	6.043	5.478	23.200	23.900
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PRICES OF PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$17.18	$19.90	$16.40	$17.98	$16.26	$17.94
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.10	15.02	15.94	15.08	16.18
June	16.13	16.52	15.84	15.60	15.63	15.53
July	16.40	16.40	15.90	15.40	15.96	15.40
August	17.16	16.09	16.17	14.89	16.20	15.16
September	18.44	15.92	16.80	14.73	17.03	14.93
October	19.75	15.90	17.84	14.05	18.02	14.88
November	19.90	.....	18.37	.....	18.09	.....
December	19.90	.....	18.15	.....	17.90	.....
Year	$17.46	.....	$16.46	.....	$16.40	.....

STOCK QUOTATIONS

COLO. SPRINGS Nov. 21

Name of Comp.	Bid.
Acacia	.05½
Cripple Cr'k Con.	.02⅝
C. K. & N.	.15
Doctor Jack Pot	.09½
Elkton Con	.75½
El Paso	.89
Fannie Rawlins	‡.05
Findlay	.07
Gold Dollar	.13
Gold Sovereign	.03½
Isabella	.17½
Jennie Semple	.10½
Lexington	.01½
Moon Anchor	.02½
Old Gold	.04
Mary McKinney	.49
Pharmacist	.02½
Portland	1.14
Vindicator	.89½
Work	‡.03

SALT LAKE Nov. 21

Name of Comp.	Bid.
Bingham Copper	‡.15
Carisa	.10
Colorado Mining	.43
Columbus Con	.28½
Daly Judge	‡4.25
Grand Central	.80
Iron Blossom	.80
Little Bell	‡1.01½
Little Chief	‡.22
Lower Mammoth	.13½
Mason Valley	.10
Maj. Mines	‡.53
May Day	.11
Nevada Hills	2.25
New York	‡.13
Prince Con	.82
Silver King Coal'n	1.80
Sioux Con	.28½
Uncle Sam	.59
Victoria	‡1.07½

SAN FRANCISCO. Nov. 21.

Name of Comp.	Clg.	Name of Comp.	Bid.
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.05	Belmont	4.45
Belcher	.49	Daisy	‡.03
Best & Belcher	.25	Jim Butler	.29
Caledonia	.17	MacNamara	.23
Challenge Con	.15	Midway	.18
Chollar	.05	North Star	.05
Confidence	‡.70	West End Con	.50
Con. Cal. & Va	.90	Atlanta	.13
Crown Point	.48	Booth	‡.09
Gould & Curry	.05	C.O.D. Con	.13
Hale & Norcross	.17	Comb. Frac	.20
Mexican	.92	Jumbo Extension	.22
Occidental	.42	Oro	.06
Ophir	1.07	Red Hill	.03
Overman	.30	Silver Pick	.06
Potosi	.30	St. Ives	.14
Savage	.09	Tramps Con	.02
Sierra Nevada	.15	Argonaut	‡1.00
Union Con	.16	Cent. Eureka	‡1.25
Yellow Jacket	.39	So. Eureka	‡5.75

N. Y. EXCH. Nov. 21

Name of Comp.	Clg.
Amalgamated	69½
Am. Agri. Chem	45
Am.Sm.&Ref.,com	80¼
Am. Sm. & Ref., pf.	106
Anaconda	41¾
BethlehemSteel pf	61
Col. & Hock. C. & I.	‡6
Federal M. & S., pf.	58
Goldfield Con	8
Great Nor., ore ctf.	59½
Homestake	‡85
Nat'nalLead,com.	‡59
National Lead, pf.	106¼
Nev. Consol	20¾
Pittsburg Coal	‡21½
RepublicI&S,com.	34¾
Republic I & S, pf.	98
SlossSheffl'd,com.	51½
Sloss Sheffield, pf.	‡116
Tennessee Copper	37
Utah Copper	50⅛
U. S. Steel, com	80
U. S. Steel, pf	118¼
Va. Car. Chem	63

N. Y. CURB Nov. 21

Name of Comp.	Clg.
Ariz.-Cananea	4⅜
Barnes King	‡.5
Bonanza Creek	‡3
Braden Copper	4¼
B. C. Copper	6⅝
Buffalo Mines	‡2½
Butte Coalition	20⅜
Caledonia	1⅛
Calumet & Mont.	1½
Canadian Mines	‡6⅝
Chino	24¼
Cobalt Central	9
Con. Ariz. Sm	1⅛
Davis-Daly	1⅛
Dominion Cop	‡7
Ely Con	54
El Rayo	3¼
Florence	1⅛
Giroux	7⅜
Greene Cananea	7⅝
Guanajuato	‡1⅜
Guerrero	1⅜
Guggen. Exp	198
Kerr Lake	7½
La Rose	4¾
McKinley-Dar-Sa	1.25
Miami Copper	20⅛
Mines Co. of Am	5¾
Mont. Shoshone	‡.14
Mont.-Tonopah	‡.92
Nev. Utah M. & S.	1⅛
Nipissing Mines	10⅞
Ohio Copper	1⅛
Pacific Sm. & M	⅛
Precious Metals	1½
Ray Central	2⅞
Ray Con	20⅝
South Utah M. & S.	1⅛
Standard Oil	‡619
Stewart	¾
Tonopah	8⅜
Tonopah Ex	1.05
Tri-Bullion	⅛
Tularosa	1
Union Mines	⅞
Yukon Gold	3⅛

LONDON Nov. 22

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 10 0
Esperanza	2 0 0
Tomboy	0 18 1½
El Oro	1 6 0
Oroville	0 7 0
Mexico Mines	7 7 6

BOSTON EXCH. Nov. 21

Name of Comp.	Clg.
Adventure	8⅝
Algomah	10
Allouez	43⅞
Am. Zinc	30
Arcadian	4⅝
Arizona Com	17⅛
Atlantic	7⅜
Bonanza	‡.50
Boston & Corbin	16¾
Butte & Balak	7
Calumet & Ariz	55¼
Calumet & Hecla	600
Centennial	18
Con. Mercur	‡6
Copper Range	‡71
Daly-West	37⅛
East Butte	13¼
Franklin	11¼
Granby	45
Hancock	25⅞
Helvetia	‡2
Indiana	15¼
Isle Royale	20½
Keweenaw	3¾
Lake	36¾
La Salle	8
Mass	‡9⅛
Michigan	4½
Mohawk	48
Nevada	20¾
North Butte	35¾
North Lake	8
Ojibway	‡8
Old Dominion	‡42½
Osceola	‡132
Parrot	‡14¾
Quincy	78
Shannon	13¼
Superior	48
Superior & Bost	7¾
Superior & Pitts	14⅜
Tamarack	61
Trinity	5½
U. S. Mining	36¾
U. S. Mining, pf	47½
Utah Apex	3
Utah Con	24
Victoria	‡3
Winona	9¾
Wolverine	‡131
Wyandot	‡2¼

BOSTON CURB Nov. 21

Name of Comp.	Last.
Ahmeek	‡185
Bingham Mines	‡2½
Boston Ely	1⅛
Boswyocolo	‡.08
Cactus	.27
Calaveras	3⅝
Champion	.05
Chemung	‡.08½
Chief Cons	1⅝
Cons. Ariz	2
Corbin	5⅛
Crown Reserve	21⅜
First Nat. Cop	2⅛
Inspiration	9½
Mackinaw	.25
Majestic	.55
Nat'l Mine & Ex	.04
Nevada-Douglas	2⅛
Oneco	2⅛
Raven Copper	.51
Rhode Island Coal	10
San Antonio	‡6
Shattuck-Ariz	‡21
South Lake	7¼
Superior & Globe	‡10
Trethewey	‡1⅛
Tuolumne Copper	5⅛
Vulture	8⅞
Yuma	.20

‡Last quotation.